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Preparation of Teachers of Secondary Mathematics[1]

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INTRODUCTION

THIS article is based upon a part of the study, "Professional Preparation of Teachers of Secondary Mathematics," conducted by the author in the winter and spring of 1940. The work was divided into two parts. In Part I an answer to the following question was attempted: What preparation do teachers of secondary mathematics need? In Part II an analytical study was made, using the findings of Part I as a criterion, of the present status of the following groups located within the bounds of the Southern Association of Colleges and Secondary Schools:

1. Teachers of secondary mathematics
2. Teacher training institutions
3. Teacher certification requirements.

In the study, secondary education was defined on three levels, namely: Junior High School, Senior High School, and Junior College. This definition is in harmony with recent writers on educational theory and practice.[2,3]

This morning we shall be concerned only with Part I of the study. A previous paper dealt with Part II.[4]

The study of mathematics on the part of all high school pupils has been widely questioned during the past twenty years. This has resulted in a steady decrease in the amount required for graduation from high school, and at the present time a good many states require only one unit. In 1931 there were thirty-nine states which required one unit or less.[5] Let us look at the chronological scale of one state. The mathematical requirements for graduation from high school in the State of Louisiana in the school year of 1917–18 were one and one-half years of algebra and one year of geometry. In 1919 the algebra requirement was reduced to one year. This order

[1] Based upon a part of "Professional Preparation of Teachers of Secondary Mathematics." Unpublished Doctor's Dissertation, George Peabody College for Teachers, Nashville, Tennessee, 1940. This paper was read before a meeting of the National Council of Teachers of Mathematics, Atlantic City, New Jersey, February 21, 1941.

[2] Leonard V. Koos, *The American Secondary School* (New York: Ginn and Co., 1927), p. 38.

[3] *The Place of Mathematics in Secondary Education*, Final Report of the Joint Commission of the Mathematical Association of America and the National Council of Teachers of Mathematics, Fifteenth Yearbook of the National Council of Teachers of Mathematics (New York: Bureau of Publications, Teachers College, Columbia University, 1940), pp. 49 and 72.

[4] H. T. Karnes, "The Training of Southern Association Teachers of Secondary Mathematics." Read before a meeting of the National Council of Teachers of Mathematics, Baton Rouge, Louisiana, December 30, 1940.

[5] Ward W. Keesecker and Franklin C. Sewell, *Legal and Regulatory Provisions Affecting Secondary Education*, Bulletin No. 17 (1932), Monograph No. 9 (Washington: United States Government Printing Office, 1933), pp. 78–82.

persisted until 1929 when one year of algebra, one year of geometry and one-half year of arithmetic were the mathematical courses necessary for the high school diploma. In 1933 another change was made; the requirement was reduced to only one year of algebra. This last requirement was altered in 1937 and read one year of arithmetic, general mathematics or algebra.[6] What is the cause of this decline in mathematics requirements? Many reasons may be given, but it would be a false statement to say that the teachers of mathematics have had nothing to do with it.

The preparation and attitude of the teacher is very likely to be reflected in the student. The following quotation from a high school senior in northern Colorado is an indication of the student point of view on the necessity for well prepared teachers:

> Everything would be fine if we had good teachers. You've been talking a lot about dull subjects that should be dropped from the curriculum. Those subjects are dull because the teachers are dull. If all our teachers were alert and interesting, there would be no such things as wasted courses. Even a course in Latin (or mathematics) would be fun and would accomplish real education if the teacher presented it the right way.[7]

If mathematics is to regain its place in the curriculum of our secondary schools, it will be necessary for the mathematician to take the lead. In many quarters the educationist has seemingly been inclined to drop mathematics, with the exception of the barest of rudiments, from the secondary school curriculum. Nevertheless, the mathematician must realize that the educationist probably knows more about the philosophy, psychology, and techniques of education for adolescents than he does and that he must accept the educationist as a co-worker and not as an opponent, as apparently has been the case in the past. On the other hand, the educationist must accept the mathematician as one who knows most about the subject and its potentialities and help him in an attempt to present his material so that it will harmonize with the best educational procedures.

Educational experimenters for many years have attempted to determine what factors are essential to teaching success. One of the best critical analyses of such extant studies is to be found in the report of a committee from the North Central Association. This committee concludes the following, in part, from its analysis:

> In view of what the Committee recognizes as inconclusive evidence regarding factors influencing teaching success, the Committee has taken the position that quality of teaching will be definitely related to the subject matter preparation which the teacher has received for the actual teaching assignment given him.[8]

The above-mentioned committee does not indicate that subject matter preparation is the only factor to be considered in the training of teachers. The academic world is agreed that many factors contribute to teaching success although the ratio of their importance has not been determined experimentally. According to Professor Paul L. Boynton, their ratio will not be determined until more refined experimental techniques are developed.[9] Until that time comes, it will be necessary to depend upon the opinions of individuals who are experienced in this field of thought.

Due to the fact that a large proportion of the literature, dealing with the preparation of teachers of secondary mathematics, is based upon opinions of mathematicians, and since some groups feel that mathematicians are somewhat biased in their

[6] John B. Robson, "History of High School Supervision in Louisiana" (Unpublished M.A. thesis, Louisiana State University, 1937).

[7] A. J. Kempner, "The Deadly Parallel," *The American Mathematical Monthly*, XLVI, No. 5 (1939), 280, quoting from the *Denver Post*, February 11, 1939.

[8] "Inadequacies in the Subject Matter Preparation of Secondary School Teachers and Suggestions for Their Correction," Final Report of a North Central Association Committee, *North Central Association Quarterly*, XII (April, 1938, A Reprint), p. 439.

[9] Statement by Dr. Paul L. Boynton, George Peabody College for Teachers. Lecture notes.

opinions, the author takes the position that a more acceptable solution to the problem may be had through the use of data collected from all groups who have anything whatsoever to do with the teaching personnel of the secondary schools. For this reason the data to be used as a basis for the suggestion of a program for the preparation of teachers of secondary mathematics were collected by means of questionnaires from the following groups with the number of respondents in each group indicated: (1) State Superintendents of Education—26, (2) State High School Supervisors of Secondary Education—38, (3) Administrators of Secondary Education—130, (4) College Teachers of Secondary Education—60, (5) College Teachers of Educational Psychology—29, (6) Heads of College Departments of Mathematics—59, and (7) Secondary Teachers of Mathematics—291. This represents a total of 633 individuals. Of this number 198 had taught a course in "The Curriculum," or had served on a curriculum committee.

It is to be noted that all phases of the work of mathematics at the secondary school level are represented by the groups listed above. Among the groups listed are to be found those who set the standards and see that they are enforced; those who, through their research, help to formulate these standards; those who employ the teachers in view of the standards imposed; those who prepare the teachers mathematically and professionally; and those who do the teaching of mathematics at the secondary level. There is no doubt but what the combined opinion from these individuals would be helpful and significant in determining a program for the professional preparation of secondary teachers of mathematics.

There are three types of knowledge to be considered in the preparation of prospective teachers of secondary mathematics, namely: general knowledge, professional knowledge, and specialized knowledge. In view of the data collected, specialized knowledge and general knowledge seem to take precedence over professional knowledge; however, all three are essential to an adequate preparation for teaching. Due to the importance of each of these three phases of subject matter preparation they will be considered independently.

General Knowledge

Breadth of outlook and understanding are essential qualifications of a good citizen. They are, therefore, even more indispensable qualifications for the prospective teachers who will be expected to play an important part in the development of good citizens.[10] This is not the only reason why a broad general education is essential to the prospective teacher of secondary mathematics. Almost every field of human endeavor has its mathematical applications. If mathematics is to be taught with "life like" situations in view, then it will be necessary for the teacher of mathematics to have an appreciation of its varied applications.

With respect to the general knowledge preparation of the prospective teachers of secondary mathematics, two specific conclusions may be drawn from the data that were collected. They are as follows:

1. The prospective teachers of secondary mathematics should contact as many of the broad fields of learning as possible. They at least should have some work in the following fields: physical science, biological science, social science, literature, and perhaps philosophy, physical education, art, and languages.
2. This phase of the preparatory process should take place at the undergraduate level, and primarily in the Freshman and Sophomore years.

Professional Knowledge

The enrollment of the secondary schools has increased greatly in the past twenty years. A teacher at the secondary level no

[10] "Inadequacies in the Subject Matter Preparation. . . ." *Op. cit.*, p. 451.

longer gives instruction primarily to a select group of college bound students, but rather is called upon to teach pupils who vary a great deal in interests and intelligence. In order for a teacher to cope with this situation, it will be necessary for him to be well prepared, not only from the point of view of the subject matter to be taught, but also from the point of view of fundamental educational techniques and principles; otherwise, he will not be in a a position to give proper instruction, guidance and service to the heterogeneous group of pupils which will be his to instruct and inspire.

In view of the data that were presented in the study, the following conclusions with respect to professional knowledge are warranted in the writer's opinion:

1. In partial fulfillment of the requirements for the bachelor's degree it would be desirable for the prospective teacher of secondary mathematics to have at least twenty-six semester hours of credit in professional course work. However, in view of the relative importance of general knowledge, it would not be necessary to take quite so much work in the professional field. This work should include methods in the teaching of mathematics, courses in psychology and education, and practice teaching.
2. Much emphasis should be placed upon practice teaching. The desirable method would be one year of internship; however, this is not feasible unless some monetary remuneration is provided.
3. The professional course work should be limited to those who have successfully completed two years of college work.
4. At all times there should be a spirit of understanding and close cooperation between the departments of mathematics and education. A desirable method to insure this would be through the services of a "liaison professor."
5. The question is still open with respect to whether the department of mathematics or the department of education should assume the responsibility for the professional training of the prospective teacher of secondary mathematics.
6. Those who are in authority should take the necessary steps to have many of the professional courses consolidated and closely linked with problems that arise in observation and practice.

Specialized Knowledge

In order to teach mathematics effectively, one must know mathematics beyond the level at which he is teaching, for "Nothing but study beyond the bare elements of a subject can make these elements seem simple and natural; nothing else can show their full significance."[11] However, according to Professor F. L. Wren, the secondary teacher of mathematics is not a "producer of mathematics," but a "seller of mathematics," and as such he is not so much concerned with the implications of the field as he is with the applications.[12] Therefore, the prospective teacher of secondary mathematics, even though he should have advanced work in the pure phase of mathematics, must also pay attention to the background, foundations, and uses of his chosen field.

With respect to the training of the prospective teacher of secondary mathematics from the standpoint of specialized knowledge, the following specific conclusions are in evidence, in the opinion of the writer, from the data that were collected:

1. As a partial fulfillment of the requirements for the bachelor's degree, it would be desirable for the prospective teacher of secondary mathematics to have at least thirty-five semester

[11] *The Place of Mathematics in Secondary Education . . . , Op. cit.*, p. 195.

[12] F. L. Wren, "The Professional Preparation of Mathematics Teachers," The Mathematics Teacher, XXXII, No. 3 (1939), 99.

hours of credit in the field of mathematics. However, in view of the relative importance of general knowledge, professional knowledge, and specialized knowledge, an amount somewhat less than thirty-five semester hours would be sufficient.

2. The college mathematical training should begin with the Freshman year.
3. Both the pure and applied phase of mathematics should be given consideration in the training of the prospective teachers of secondary mathematics, the emphasis being placed upon the applied phase insofar as is possible.
4. The history of mathematics and the foundations of mathematics should be given due consideration in the preparatory process.

Other Considerations

In addition to the subject matter preparation of secondary teachers of mathematics, there are some other factors that are pertinent to their training. These factors are as follows: (1) academic degrees, (2) teaching combinations, (3) distinction in preparation between the three levels of secondary teaching, (4) raising of standards, (5) attributes of the desirable teacher, and (6) teacher placement. In view of the data that were used in the study, there appear to be some specific conclusions to be made with respect to these six factors. These conclusions follow:

1. Academic degrees
   (a) The junior high school teacher should have at least the bachelor's degree.
   (b) It is highly desirable that the senior high school teacher have the master's degree. The trend is apparently toward its becoming a prerequisite for teaching at the senior high school level.
   (c) The junior college teacher by all means should have the master's degree, and it is desirable that he have the doctor's degree.
2. Teaching combinations
   In view of the possibilities that a teacher may have to teach subjects other than mathematics he should prepare himself in at least one other field. It is desirable that this field be closely allied to mathematics; however, the indications are such that the prospective teacher of mathematics may choose a field to his liking.
3. Distinction in preparation between the three levels of teaching
   The distinction to be made between the preparation of the junior high school, the senior high school, and the junior college teachers is one of amount and not type. In other words, the same general plan of subject matter preparation should be followed by all of the prospective teachers of secondary mathematics; however, it is not necessary for those on each level to have earned the same academic degree.
4. Raising of standards
   The principal agents to provide for the raising of the standards of the teachers of secondary mathematics are the state departments of education. However, in order for this to be done effectively, the state departments of education and the teacher training institutions should cooperate in determining what these standards should be.
5. Attributes of the desirable teacher
   The attributes that one would like to see in a teacher are numerous, so nunerous in fact that it is highly improbable that one individual would possess all of them. However, in view of the implications of the study, it seems imperative that the prospective teacher of secondary mathematics should have at least the three following characteristics: (1) scholarship, (2) ambition, and (3) good health.

6. Teacher Placement

College departments of mathematics should be consulted to a large degree with respect to the placement of teachers of mathematics in the secondary schools.

Recommended Programs for the Preparation of Secondary Teachers of Mathematics

In view of the data that were used in the study, the suggested programs that are to follow seem to be justified. Since the distinction between the preparation of the teachers for each of the three levels of secondary teaching has been indicated, the programs are devised with respect to academic degrees.

Program for the Bachelor's Degree. Due to the average amount of credit in mathematics (thirty-five semester hours) and in professional course work (twenty-six semester hours) recommended by the 633 respondents, and in view of the relative importance of general knowledge, professional knowledge, and specialized knowledge based upon the opinions of these respondents, two different programs (designated as Type I and Type II) are devised for the prospective teacher of secondary mathematics who is working towards the bachelor's degree. Both programs are built on the assumption that 128 semester hours of credit are necessary for graduation. The differentiation between these two programs follows:

Type I. This program is to be considered as the desirable course of study with respect to professional knowledge and specialized knowledge. It is devised in consideration of the thirty-five semester hours of credit and the twenty-six semester hours of credit recommended for work in mathematics and professional study respectively. As is to be noted, this will leave approximately one-half of the student's time which can be devoted to the acquisition of a general knowledge.

Type II. This program is to be considered as one containing the minimum amount of work that should be devoted to the acquisition of a professional knowledge and of a specialized knowledge. The amount of credit in mathematics as recommended in this program is in consideration of the twenty-six semester hours of work required on the average of students who major in mathematics in the colleges of the Southern Association of Colleges and Secondary Schools.[13] The amount of credit in professional work recommended is in consideration of the average number of semester hours (eighteen) required in order to obtain the highest type of teaching certificate offered by the eleven states in which the Southern Association operates.[14] On the basis of this program, approximately two-thirds of the student's time would be available for work of a general nature.

I. Mathematical Courses

Course	Semester Hours *Type I*	Semester Hours *Type II*
1. College Algebra, Trigonometry, and Analytics (Plane), or General Mathematics	9	9
2. Solid Geometry (unless studied in high school)	1	1
3. Differential and Integral Calculus	6	6
4. Advanced Euclidean Geometry	6	3
3. Applied Mathematics (After Richtmeyer)[15]	6	2
6. History of Mathematics	3	2
7. Theory of Equations	3	3
8. Descriptive Geometry	1	
9. Fundamental Concepts of Mathematics	2	
Total	37	26

II. Professional Courses

Course	Semester Hours *Type I*	Semester Hours *Type II*
1. Teaching of Mathematics[16]	6	3
2. Psychology (General)	3	3
3. Educational Psychology[17]	3	3
4. Practice and Observation	6	6
5. General Methods of Teaching	3	
6. Tests and Measurements	3	3
7. Principles of Secondary Education	3	
Total	27	18

III. General Preparation

Courses are to be selected from each of the following fields. One field should be chosen as a minor with a second teaching subject in view. It is desirable that the minor field be one that is closely allied to mathematics: Physical science, biological science, social science, literature (English grammar and composition included), physical education, philosophy, art, and laguages.	64	84

Program for the Master's Degree. The following programs of studies are recommended for the prospective teacher of secondary mathematics who is working towards the master's degree. Two types are suggested:

Type I. This program is constructed upon the assumption that thirty-two semester hours of credit are necessary for graduation. It is understood that no thesis is required.[18]

Type II. This program is constructed upon the assumption that twenty-four semester hours of credit are necessary for graduation. It is understood that a thesis is required.

I. Mathematical Courses

Course	Semester Hours *Type I*	Semester Hours *Type II*
1. Mathematical Theory of Statistics	3	3
2. Courses of three semester hours each from the following list:		
(a) Advanced Euclidean Geometry (unless six semester hours have already been earned).		
(b) Applied Mathematics (After Richtmeyer) unless six semester hours have already been earned.[19]		
(c) Modern (Higher) Algebra, Analytics (Solid), Differential Equations, Projective Geometry, Advanced Calculus, and Mechanics	12	9
Total	15	12

II. Professional Courses

Course	Semester Hours *Type I*	Semester Hours *Type II*
1. Study into the Problems and Literature in the Teaching of Secondary Mathematics.	3	3
2. Statistical Methods in Education.[20]	3	3
3. Courses of three semester hours each from the following list:		
(a) Principles of Secondary Education (unless already studied).		
(b) The Curriculum, Philosophy of Education, History of Education, and Psychology of Learning.	6	3
Total	12	9

III. General Courses

Course	Semester Hours *Type I*	Semester Hours *Type II*
Some advanced work in a field closely related to mathematics	5	3

Program for the Doctor's Degree. The program of studies which is to follow is recommended for the prospective teacher of secondary mathematics who is working

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[13] Part II of the study. See footnote (4).

[14] *Ibid.*

[15] Cleon C. Richtmeyer, "A Course in Applied Mathematics for Teachers of Secondary Mathematics," THE MATHEMATICS TEACHER, XXXI, No. 2 (1938), 51–62.

[16] The content of this course will depend upon the level of teaching for which the student is preparing.

[17] The content of this course should be devised in view of the psychological problems that the prospective teachers will face and especially the nature of the pupils they will teach.

[18] While it cannot be justified from the data used that more course work should be taken in lieu of a thesis, a thesis is deemed unnecessary by the report "On the Training of Teachers of Mathematics," conducted by a commission of the Mathematical Association of America, *The American Mathematical Monthly*, XLII, No. 5 (1935), 272.

[19] Cleon C. Richtmeyer, *op. cit.*

[20] Since the student will have had a course in the Mathematical Theory of Statistics, this course should pay attention to the interpretation of statistics as applied to education rather than the mechanics of statistics.

towards the doctor's degree. Since the requirements for the doctor's degree do not depend entirely upon the amount of work pursued, no attempt will be made to indicate the semester hours of credit.

I. Mathematical Courses

An attempt should be made on the part of the student to acquire information of an advanced nature with respect to the three fields of mathematics, namely: algebra, geometry, and analysis. He should not enter into this work primarily with the attitude of a research worker, but rather as one who is in search of knowledge which may be used in the instruction, guidance, and service of the pupils he is to teach.

II. Professional Courses

1. A continuation of study into the problems and research of the teaching of secondary mathematics. Out of this work a dissertation should evolve which is to be submitted in partial fulfillment of the requirements for the degree.
2. For a minor course of study, the student should select work in some particular phase of the field of education as applied to secondary teaching.

III. General Courses

It would be desirable for the student to pursue more work of a general nature insofar as is possible. This work should be of an advanced nature and more or less closely related to mathematics.

Some Remarks on the Article by Irwin M. Rothman in THE MATHEMATICS TEACHER for November, 1944, pp. 311-313.

By RICHARD MORRIS

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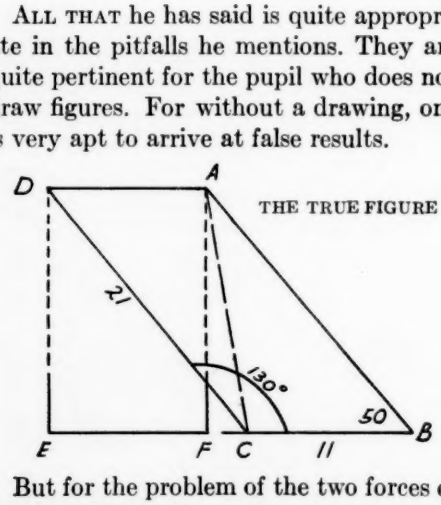
ALL THAT he has said is quite appropriate in the pitfalls he mentions. They are quite pertinent for the pupil who does not draw figures. For without a drawing, one is very apt to arrive at false results.



But for the problem of the two forces of 11.00 and 21.00 lbs. acting at an angle of 130°, the figure displayed is quite inaccurate. A student of Plane Trigonometry should be able, by means of protractor and a suitable unit, to construct a reasonably accurate figure. If one such is made, it will show that the resultant line AC bears N.W. and not N.E. as is shown in the figure. The pitfall, in the correct figure, vanishes into thin air. For the positive angle which the resultant makes with the 11.00 lb. force is evidently obtuse. If the student is acquainted with orthogonal projections, which should be the case, the horizontal and vertical projections of the 21.00 lb. force on the 11.00 lb. force, will give a right triangle, whose legs are the vertical projection and the horizontal projection minus the 11.00 lb. force, with its hypotenuse the resultant. A quite careful figure, showing the projections with respect to the 11.00 lb. force, after some simple calculations, will reveal the angles the resultant makes with the forces.

A safe procedure: Draw an accurate figure.

Come Over into Macedonia

By WILLIAM G. SHUTE
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I SHOULD like to discuss some of the problems of the classroom teacher. I want to talk about a possible aroused and enlightened public opinion expressing itself through our school administrators. I want to venture the hope that these Pauls may speedily set sail from Troas to bring renewed confidence to our conscientious teachers in Macedonia.

At a recent meeting of an eastern association of Teachers of Mathematics, Dr. Thomas J. Quirk, Principal of the Hartford Public High School, said in his welcoming address, "The most important factor in the teaching of mathematics is the teacher." It was good to hear these encouraging words; it did not hurt us to enjoy for a time a pharisaical sense of superiority. We all were in full accord; our years in the classroom had convinced us of our own tremendous importance.

But we have not been particularly successful in convincing others of our unique value. My Headmaster has on more than one occasion declared that the ideal school consists of Mark Hopkins on one end of a log and the student on the other. But the fact remains that those who are planning to enter their sons in our school invariably inspect the log but seldom do they inquire for Mark Hopkins. In all my years of teaching, only once have I been questioned by a parent to find out what sort of a teacher I was. On that occasion, a good Quaker grandmother sent her son to check on the views of the future Bible teacher of her grandson. The content of the Bible course worried her but she was not concerned about my ability to teach her grandson mathematics; the subject was never mentioned.

Thus the parents may pass us by on the other side but among those whom we have taught we find a devotion and appreciation far beyond our deserts. We are continually astonished to find the impress we have made upon our pupils. One former student, a leader at Yale, an artillery officer in the last war, second only to Hoover in the administration of relief in a province of Poland, returned to his own town, carried on a successful business, and, at the same time, devoted himself to the moral and physical instruction of a group of boys and young men. He did this civic work, he said, to repay his high school mathematics teacher for what he had done for him as a boy. I knew a university dean, concerned about his son's education, who ignored his colleagues and the son's instructors and, instead, consulted his old teacher who had taught the dean in his academy days. I know a young man who had been directed by family tradition toward one of America's oldest colleges who turned instead to a great technical school where he made an excellent record because, he said, of the discipline and inspiration of his mathematics teacher in his secondary school. There is a successful salesman of silverware down in Alabama who insists that his success is due to a technique he mastered from his teacher in secondary mathematics. Each one of us here can cite from the testimony of our former pupils many favorable impressions which we made upon them; few of us can recall what we ever did to merit this praise. As we look back upon our own experience as pupils, we remember that it was not the principal of the school nor the Dean of the college who made an impress upon us. Invariably it was some individual classroom teacher whom we remembered, if not with love, certainly with great respect. Winston Churchill, whose words could lift all England and the English-speaking world, attributes his ability to write and speak, not to the universities of England, nor to Harrow, but to "a delightful and

sapient teacher of English named Somerville." Somerville was just a classroom teacher in grades corresponding to those of our junior high school yet, by his love and enthusiasm for good English, he so inspired young Churchill to cause him to become the most forceful speaker among the free peoples of the world. And no matter how much we fell in love with Mr. Chip's sweet and charming wife in "Goodbye, Mr. Chips," nevertheless, it was not because of her nor because of Chip's tea and sweet cakes that his pupils, when men, turned to Mr. Chips again. It was because he could, in spite of every fury, run a study hall of young boys or so prepare his older boys that when they went up to the universities they made honors in Latin. The character, the scholarship, and the self discipline of the teacher had forever won the love and respect of student and alumnus.

An informal committee of the Progressive Education Association recently issued a report, entitled "New Methods vs. Old in American Education." The report says in part, "It had been assumed that the teaching method has a greater influence than the teacher himself on the achievement and development of the pupils." However, the report concludes that "About 41 per cent of the differences between the classes was accounted for in terms of the rated differences between the teachers in their ability to carry out their work, . . . about 2 per cent of the difference between classes could be ascribed to differences in method, . . . the remaining 58 per cent must be accounted for in terms of the differences among the various classes regardless of teacher or method. . . . Parents concerned with the amount which their children achieve in the various academic subjects apparently should send their children to schools run by able people." Now all this is comforting testimony to us teachers but too few people outside the classroom believe it or, if they do, pay very little attention to it.

Why isn't there more concern about the teacher and less about the material which makes up the classroom? It is not a simple question to answer. We only know that we are acted upon by forces which previous generations never experienced. In the past two decades we have seen the electrical power in the United States alone increase at the rate of 1,000,000 horse power a year, while the increase in power of our internal combustion engines probably now exceeds a billion horse power annually. Twenty-five years ago it required 246 minutes to produce a unit of food; today the time has been reduced to 100 minutes. Only yesterday we thought we were good when we completed a finishing process on an airplane cylinder in 35 minutes; today we can do it in less than 2 minutes. Ours is the era of the assembly line, labor unions and mass production. Man has mastered so many physical forces, has discovered so many material resources, has pushed back so many mysteries, that he has begun to worship the golden calf of scientific technique and technological advance. We agree with Ann Lindberg when she defines civilization as "highly scientific, mechanized, and material." F. E. Searle Superintendent of the Ford Schools says, "Things have come to us as a people so fast and in such variety during recent years that our sense of values has been quite upset. Things a previous generation did not have and of which they had never heard we demand for ourselves and insist that our lawmakers provide them for us from the general store. This attitude we are bequeathing to our children—a bequest fraught with the gravest danger."[1]

With our increased wealth and its wide distribution, we built palatial schools and colleges. To these we first invited our boys and girls, our young men and women, and then passed laws and went out into the highways and byways and compelled them to come in. I remember how the dean of one of our schools of education was terribly concerned over a few million children

[1] Searle, Frederick E. *Training Youth for Industry*, p. 1.

who, at the time, were not in our high schools. We certainly stressed quantity production. Laws were passed and regulations made which debarred our young men and women from certain jobs if they were without high school diplomas. By increasing the age limits within which compulsory school attendance was required, certain pupils became discontented time-servers and too often scholarship went out of the window. Former standards crumbled and new untried methods of necessity were devised. As we studied our educational plan, considering the results we were getting, the cost was terrifying. Only wealthy America could afford such an expensive program. And the pity of it all, thousands of our teachers were receiving only a pittance. Too many Americans were more interested in diplomas than in learning and were unwilling to submit their children to the discipline to which they themselves had been subjected. They had increased enough in wealth to be lenient.

In our mass education, the curriculum was extensively modified and, in the adjustment, mathematics received its share of rough treatment. In the mathematics classroom the extremes in ability of pupils stood out clearly. I was shocked beyond words when first I learned that, in a certain high school in a neighboring state, movie appreciation had been substituted for elementary algebra, and then I was doubly shocked when a supervisor of education in a second state told me not to get excited about it—that the change was probably for the better. Just imagine how those teachers in that school felt when they saw one of man's most helpful and cultural subjects thrown into the ash-can —to see Gable, Powell, Hope, and Taylor replace Vieta, Descartes, Newton, and Gauss.

A few years ago I heard a consecrated teacher lecture before one of our meetings on "Practical Mathematics." He showed how the introduction of that course had ruined the standards in the whole department. Apparently from necessity the Practical Mathematics was so organized that all who elected the course would pass. Before long the students found this out and the majority quit working. When those in elementary algebra heard of the academic sit-down strike, they asked the question, "What's the use of our working? Let us, too, elect Practical Mathematics and coast along." Before long the virus of inactivity had affected the college preparatory algebra class and, in turn, weakened the next succeeding course and so on *ad nauseam*. Here were teachers who wanted to do what they were hired to do, to teach effectively and well, but who were hog-tied to a course which in itself could be altogether worth while but which was nevertheless demoralizing the department. Before the speaker finished we wanted to paraphrase Gilbert's verse to sing, "A teacher's lot is not an 'appy one." "Many teachers who feel themselves competent to deal with pupils of normal ability are perplexed if not in despair over the question of instructing those of inferior ability."[2]

The Dean of Admissions at Yale told us of a young man who applied for entrance and who submitted grades, all of which were in the nineties. Upon investigation, the dean found that the Board of Education of the town in which the young man lived, had passed a rule stating that no child should receive a grade less than 90 nor higher than 95. You can easily imagine the effect of such a regulation on pupil and teacher alike. The American people are probably getting for their children the kind of education for which they are willing their children to be disciplined, but they are paying for a great deal more.

You probably know the results of some of the questions submitted to hundreds of high school graduates as they applied for entrance to one of our large city universities a few years ago. When asked to simplify the fraction 4 divided by 4, 60% of the candidates failed. Only 10% attempted to simplify $\sqrt{(a+b)^2}$ and of those who

[2] Fifteenth Yearbook of The National Council of Teachers of Mathematics, p. 124.

tried, less than half were successful. In Dr. Harold G. Campbell's report on New York City Schools there is a chapter "Teaching Now and Twenty Years Ago." Teaching twenty years ago was a sinecure, in fact, it was "tranquil." "Our students on the whole fitted comfortably into the curriculum or left us." Discipline was simple in the old days "for there was practically no freedom allowed among the children and parents cooperated fully in maintaining discipline in the homes," and finally, "the high schools today believe that to expect a pupil to do a thing which he is unable to do and to brand him as a failure when he fails to do it, is unjust to the pupil and a waste of educational resources."

In our education we have stressed freedom at the expense of order. Because perfect order meant regimentation, intolerance, and tyranny, we turned to freedom only to find too much selfishness, a lack of standards, and an unwillingness to exercise self-discipline and self-control. We have assigned to our teachers a colossal job and too often we have failed to give them sustaining support. Some teachers have dismissed their problems with a why worry attitude, coasting along with the crowd, superficially pleasing everyone, and devoting only a minimum of effort to their job. Others are giving, with a full measure of devotion, their very life blood to their appointed tasks; these valiant souls more than anyone else demand and maintain high standards of character and scholarship in our schools. It is for these that the cry goes up to high heaven, "Come over into Macedonia and help us."

How does our Commission, these men and women of the highest character and scholarship in mathematics, react to this cry for help? May I quote, "Administrators should feel deep concern over the large number of pupils who find themselves without adequate preparation for the activities, professions, or additional studies which they later wish to undertake. A strong and corrective influence should be exerted upon those boys and girls who are capable of doing fair work with secondary mathematics but who, although they have no serious dislike for the subject, and insufficient knowledge to form a sound opinion, think it unnecessary and yield to what is easiest or most glamorous at the moment"[3] and again, "The effort to make mathematics a prominent feature of education implies the desire to keep secondary education on a high level, with respect to both the ideals that inspire it and the standards of achievement that are expected,"[4] and to this we quickly add "Algebra (and Latin) hold the unenviable distinction of being the most difficult subjects for the dull-normal pupils.[5] Now all these remarks are directed toward administrators, not toward teachers. In the large, teachers will maintain standards if they are supported. A Professor at Princeton was asked what private school over a long period of time sent to him the best students. He readily named the school and added that he believed its boys excelled because the scholarship of the school was entirely determined by the teaching faculty. You and mine declare in no uncertain terms that school administrators must take a stand for sound scholarship. In the last analysis that means to most of us that someone has got to be unpleasant and consistently so. It probably means that some arbitrary standard which has prevailed so long in Europe and in our privately endowed universities must be reestablished. As much as we would like to, we can not establish standards by smiling through. The man of the street is saying that too many good pupils are failing because of the lack of character of both educator and pupil. We know only too well that often it is the superior pupil who form the retarded group in our schools. Witness the recent criticism in the New York papers over the failures in the Four Year English Regents examination

[3] *Ibid.*, p. 44.
[4] *Ibid.*, p. 51.
[5] *Ibid.*, p. 133.

Our people are getting fed up with the alibi "Examinations are too difficult." And when our citizens truly make up their minds that they are willing to pay the price in character to see their children educated, the teachers will more than carry on.

If we read the pattern of history correctly, help will soon come to Macedonia. In spite of the deceit of inflation, we are all going to be a whole lot poorer than we are or have been. Our taxes are going to force us to make many unfavorable readjustments. The cost of our safety will be so great that we shall be unwilling to support any system of education that is not paying full dividends. In our major endeavor, the pendulum of public opinion will of necessity swing back toward increased regimentation, severer discipline, and more order. Our economic necessities and national needs probably cause us to follow President Hutchins' demand for more education instead of less. From an over indulgent nation, seeking to avoid labor, we may become again a people accustomed to hard work demanding a high degree of skill. And here the junior high schools will come into their own. Whatever other function the junior high school may have an important one is to offer a wide sampling of courses in order to assist the pupil in selecting future studies in which he is interested and for which he has some aptitude. In the very near future, because of the National Emergency Training Program, our educational system may include hundreds of thousands of factories and commercial houses throughout the country. For years we have depended upon skilled workmen from Europe but the restriction of immigration has stopped this influx of master craftsmen. Our educators themselves have discouraged good students from entering industry and often have advised only those who had trouble with classroom work to enter our factories. Educators and students today have come to the conclusion that a high grade of intelligence is required in the skilled trades and no stigma is attached to those preparing for such work. Mass production, closer limits of measurement, the increasing importance of the time element, the extensive equipment of industry, the vast quantity of raw material necessary to give the learner a chance to repeat a given operation in sequence hundreds of times, if necessary, makes industry better fitted than our schools for training industrial workers. The Ford Motor Company training school and similar schools run by great corporations, are without question the most popular schools in the country. One Ford school alone has 8000 on the waiting list. Following the pattern laid down by these private schools of industry, schools in factories and commercial houses will probably be established throughout the nation and into these our junior high schools, upon advice of the various teachers, will graduate many of their pupils. Our mathematics courses of the 7th to 9th grades, with their increased emphasis on geometry and trigonometry, as recommended by the Joint Commission for the junior high schools, are wonderfully suited for student preparation to these private schools of industry. It would have been good for each one of us if we also could have had the training which these schools offer—doing useful constructive work, earning in part our own living, developing a confidence in our own ability, fighting for our security and not depending upon the bounty of our family, the state, or nation. And perhaps, best of all, "the student under such training sees the job that is being done is within his comprehension. He learns that this is so with everything in life, that every task that is within the power of man to do must first be split into simpler parts and those performed in their right order, after which the units must be reassembled into the completed whole."[6] Boys and girls, going from our junior high schools into work and training in industry, commerce, and other fields as opportunity arises, will, upon completion of their courses, be given the

[6] Searle, Frederick E. *Op. cit.*, p. 4.

equivalent of the high school diploma so that no doors may be closed to them by some of our state laws poorly conceived and hastily written. The pupils who go on to the senior high school will be subjected to the same exacting standard as those who enter industry. The state, with its wide variety of private training schools to offer, must not permit time-servers to clutter up the classes in the senior high schools.

Perhaps we are incorrectly reading the pattern of history. With war imminent,[7] our national labor government, with its constantly increasing power over our individual citizens and the governments of our states, may turn our paths toward a new and unexplored country. The mathematics in our secondary schools, as defined by the Joint Commission and as understood by you and me, may disappear from the classroom. But if we are going to hold to our course, if we are going to cling to our objectives, Paul must quickly set sail from Troas with help to Macedonia.

[7] This paper was read June 1941.

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Is Your Mathematics a Live Resource or a Language for Parrots?

By George Gardner
Salt Lake City, Utah

E. T. Bell says, "In mathematics it is new ways of looking at old things which seems to be the most prolific source of far reaching discoveries."

The Carnegie Foundation for The Advancement of Teaching has looked at some old things in new ways. One of its reports, "An Experiment in Responsible Learning," deserves the careful attention of mathematics teachers.

Count Alfred Korzybski says in that monumental work, *Science and Sanity* —which has been ranked by scientists and mathematicians along with the works of Einstein—that, "Any student of science, or of the history of science, can hardly miss two very important tendencies which pervade the work of those who accomplish most in this field.

"The first tendency is to base science more and more on experiment; the other is toward greater and more critical verbal rigor. The one tendency is to devise more and better instruments." The instruments of measurement are among those more and better instruments.

In this article I wish to raise some questions about some of our instruments of measurement, used in the teaching field. I wish also to call attention to some of the inferences in the Carnegie Bulletin.

Those who conducted the experiment discovered at once that there were no suitable instruments for measuring the results of the experiment. In devising their instruments and perfecting their methods they found it necessary, first to determine just what it was they were attempting to measure. This problem led to the question, What are the purposes or the objectives of education?

The answer was, in brief, that it is *durable assets* and *live resources* that are the prime interests and purposes of education. "The important objects of education are (1) to understand as the result of knowledge and (2) to apply understanding with the best effects. This is sound emphasis. It embodies the necessary principles on which intelligent life proceeds. . . . "

Mathematics teachers owe it to their students to study this Bulletin.

The writer became deeply interested in the "Experiment in Responsible Learning." The principles disclosed seemed to have pertinent application to the teaching of geometry. Teaching in this field became simpler and a far more serious business. My task as indicated by this monumental experiment was, "to exhaust every resource in finding for each pupil that magic area in which 'profitable thinking' can and will be done, ideas be mastered, and working knowledge retained. . . . When the test is applied and gains or losses are revealed, one fact must infallibly appear; the school must ensure that what is measured is the pupil's permanent capital, with power behind it and use to make of it."

It is one thing to see your task and quite another matter, in a large high school, to perform it satisfactorily, even under the most favorable supervision. But to see it and attempt it is a high satisfaction.

Obviously this type of teaching requires quite a different type of test to the type that attempts to require or keep the pupils of the class moving evenly on a solid front in military step. Such a front can and may be kept in physical movements, but seldom can in movements of the mind. It is neither possible nor desirable in the type of learning conceived in the Carnegie Experiment.

At the close of the first semester of the geometry course, while pondering over a

suitable test or measure of matured knowledge or durable assets or live resources acquired, there came an opportunity to use a mimeograph test covering that part of the text used.

There were four sections of the test: True-false; multiple choice; completion statements; and numerical exercises; in most cases a number or an abbreviation would complete the answer for the numerical problems.

There were 161 questions; 50 minutes were allowed for the test.

The results were enlightening. Scarcely a student in the three classes had time to complete the test. Since there was slightly more than twenty seconds, on the average, allowed to read, understand, decide on the answer, and write it down it is obvious that there was little time left for thought or for checking answers or conclusions.

While I had been assured that the time would be ample I had failed to check that very important element of my measuring device. This neglect was doubly serious since I had constantly stressed the importance of thoughtful and careful reading of the problem before attempting to solve one. I had stressed with equal emphasis the need of testing or checking an answer before recording it.

I had brought to them ideas from Walpole's chapter on intensive reading and quoted, "In business, in war, and in other matters-of-life-and-death we sometimes have to make up our minds quickly if we are to survive; but, at other times, instantaneous decisions are not the most efficient. Those central decisions which guide our conduct toward ourselves and the universe we have a life time to make, and, as Glaucon pointed out to Socrates, it is shockingly inefficient to solve such problems too quickly."

For the most part the students followed my instructions. There was evidence of careful thinking, checking by drawings and other devices I had taught. But they were confused when the time closed in on them before they were through. They were also confused when I gave too much weight to this particular test. Their parents were confused.

I give this illustration, not to criticize the test nor to criticize those who compiled it and were generous to allow me to use it but, to illustrate an important principle in the teaching of mathematics that I venture to believe is ofttimes overlooked. It is a powerful principle, one that gives mathematics itself its clarity and usefulness. It is a principle of measurement.

In order to measure any substance, quantity or thing with satisfactory accuracy, it is first necessary to understand what is to be measured. It is then necessary to select the device best suitable to measure the thing intended to be measured.

If the reader will be good enough to reflect a little upon this matter he cannot fail to appreciate the importance of those two statements. Let us use a few simple and then a few complicated illustrations. A yardstick will measure length in yards. A clock will measure time, a thermometer will measure temperature, a barometer will measure altitude and we might name a multitude of such devices. But a yardstick will not measure time, a clock will not measure length, a barometer does not measure sound with any degree of satisfaction. Each measuring device is designed for a particular purpose.

Some measurable quantities have similar elements and serious mistakes are made if improper devices for measuring are used. Korzybski calls our attention to such mistakes in his recent books *Manhood of Humanity*, and *Science and Sanity*. He says, "Everyone knows for example, that to mistake solids for surfaces would wreck the science and art of geometry; anyone knows that to confuse fractions with whole numbers would wreck the art and science of arithmetic. . . . No bridges could stand or even be built if we tried to apply rules of surfaces to volumes. The rules of generalization in the two cases are different, and so the results of such similar confusions must be disastrous to us all."

In the case where I had selected an

examination with 161 questions to be answered in 50 minutes, I had selected a measuring device designed, it would appear to measure memory, rather than profitable thinking done. I think that a good student might memorize the definitions and the theorems of that section of the book in a week's time, then pass a good examination on the test.

One of the poorest students in the three sections, the one who had made the least preparation and paid the least attention in class got the suggestion from a student of the previous year that to memorize the theorems and definitions would enable her to pass. She began this memory task a week before the final examination. Without excessive cramming and with less than normal intelligence she not only passed the examination but passed with a higher grade than several other better students. Twelve weeks of individual instruction since that time serves to show how meagre was the understanding and the understanding how to use. This student was like Korzybski's parrot, who, if he lived long enough, might memorize most of the verbal knowledge of our time. Even then he would still be a parrot, nothing more.

To quote the Count again, "Here I want to make it very clear that mathematics is not what many people think it is; it is not a system of mere formulas and theorems; but as beautifully defined by Professor Cassius J. Keyser, in his book, *The Human Worth of Rigorous Thinking*, mathematics is the science of 'Exact thought or rigorous thinking,' and one of its distinctive characteristics is 'precision, sharpness, completeness of definition'."

How can we train for precision, sharpness, completeness of definition, exact thought or rigorous thinking at the rate of a question each 20 seconds?

The Carnegie Bulletin says, "Sealing a course with a test and a credit is like putting out a candle that has just been lighted in a dark room; one hastily notes down what one has only vaguely seen and hardly understood . . . the above comparison suggests a test which by its very structure informs the student and keeps him aware of the whole subject with which it deals—its elements, its central relationship, its more typical implications, its fastest growing development. . . . The important thing is the actual thinking the student does for himself about what he sees. This the test should measure, and should have no necessary relation to any course."

To understand the full significance of the above statement will enable us to see more clearly the need of understanding just what it is we are aiming to measure with the test and also to see the importance of measurements in general. The yardstick for example is more than a piece of wood. It is a symbol and as a symbol it is a language. As a stick it may be used to measure a piece of land. It is also a symbol of a unit of length and of width and thus a symbol of surface, and of ownership. It becomes a language when a record of this surface is recorded in the county offices. It tells the owner where to build his fences and where to place his home. It tells the neighbors the limits of their rights, where their gardens may not be planted and where the chickens may not scratch.

A piece of money is a measure; a measure of value, a token, and a language. It is also a storer of value. It may be the storehouse of a day's labor or a sack of flour or an automobile even though the laborer or the farmer or the workman may long have been dead. The man who holds the money may call for the labor or the flour or the automobile without the trouble of measurement since the money has also measured it and silently gives the value.

In length we use one dimension, in surface we use a higher dimension. The money is a measure of a higher dimension, that of time as well as other dimensions mentioned. It is a product of "time and toil."

Of the four dimensions time is, perhaps, the most important to man. Those who may hesitate to agree with this idea should read, *A New Concept of Life;* or for that matter the entire book *Manhood of Humanity*, by Count Korzybski;

and ponder over his new definition of man. He says that human beings are time binders. And he points clearly to the need of that dimension in our language.

The reader may wonder why this illustration has been used. It is by a study of this definition and these books of the Polish Engineer and Scientist that we behold the significance of the time-binding capacity of man and also see the extreme importance of understanding what it is we are attempting to measure before devising or selecting a measuring device devised by some one else for other purposes.

A test for measuring the progress or success of a student in geometry should measure something more than memory, if our students speak a higher language than that of parrots. A test for men should measure something of a higher dimension as well as memory. It should be a test of matured knowledge, of working knowledge. It should be measured by the time dimension.

I have two students of equal mental ability this year. One works for a unit of credit and for the purpose of getting a high grade. Experience has shown that knowledge held in place by such considerations does not last and in general is not worth learning or even measuring. The other is fascinated by every new idea and theorem. These ideas become his permanent capital. As he does his farm chores in the evening he thinks of applications for the principles. A mere suggestion that one of the principles leads into trigonometry, or analytic geometry or calculus opens up these various doors to other hidden treasures of wisdom. Numerous problems come to his mind and he applies his mathematical principles to their solution. Mathematics will always be a live resource to him.

In four years these two students will, most likely, present to the university a unit of credit in geometry, by means of the transcript of credit. Like money it is a currency, a measure of stored information. It passes at the university for the same value.

In the case of the one student the information will have vanished almost as a dream. The other will have applied his information, carried his theorems on into other branches of mathematics and they will have taken root. His facts have been combined with other facts and have become ideas and inventions. He speaks the language of mathematics and thinks rigorously. The seeds of geometry have been planted in his mind, as it were. They have grown in the garden of his mind. They become ideas and feed on and digest the fruits and the labor of the past. They appropriate the experiences of the past and use them as intellectual capital for development in the present; and the student passes them on down through literature to the future.

If this educational currency, known as credits, were a proper measure with that higher dimension of time as an important part of the instrument, one student might easily present a great deal more currency because of a great deal more understanding and understanding how to apply his knowledge.

Teaching for Meanings

IF TEACHERS took the vow to teach no arithmetical idea, process, or skill unless they could make it sensible to children, they would have to change drastically their classroom practices. They would find that they have to teach arithmetic mathematically, for the sense in arithmetic inheres in the mathematics of numbers and of number processes. This statement does not mean that visual and other sensory aids would be discontinued. Quite the contrary; their use would be doubled or trebled, for through such aids many mathematical meanings and relationships are most readily represented. (William A. Brownell, "Essential Mathematics for Minimum Army Needs," *School Review*, October, 1944.)

Graphic Determination of the Roots of a Quadratic Equation

By EMERY E. WATSON
Iowa State Teachers College, Cedar Falls, Iowa

CONSIDER an equation of the form, $x^2-2ax+b^2=0$. In the figure opposite, let $PQ=AB=2a$ represent the sum of the roots of the equation, and let OC be the perpendicular bisector of both PQ and AB. Also let $PA\cdot QB=b\cdot b$ the product of the roots. *Method A.* If the roots are real, $b^2\leqq a^2$. Then $x=OQ\pm CN=a\pm\sqrt{a^2-b^2}$, and roots may now be read from the diagram.

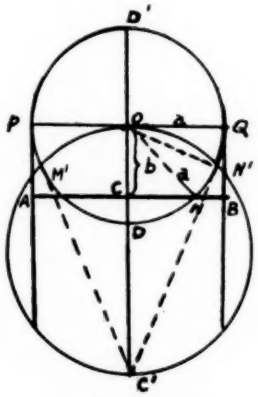


FIG. 1

1. If the roots are equal, $b=a$ and $CN=O$. Hence, $x=OQ$.
2. If the roots are conjugate real roots $a>b$. Hence, $CN=\sqrt{a^2-b^2}$, and $x=OQ\pm CN=a\pm\sqrt{a^2-b^2}$, where $a>b$.
3. If $b>a$, the roots are conjugate imaginaries and may be found as follows: Let $b=OC'$. On OC' as a diameter construct a circle cutting the given circle in N' and M'. Then $(C'N')^2=(OC')^2-(ON')^2$, or $(C'N')=\sqrt{b^2-a^2}$. Hence, $iC'N'=\pm i\sqrt{b^2-a^2}$. Therefore the roots are $x=OQ\pm iC'N'=a\pm\sqrt{a^2-b^2}$.

Method B. If the roots are real, they may be found as in Method A.

If the roots are imaginary, let the line

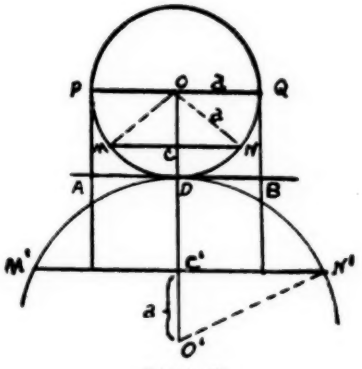


FIG. 2

through O and C intersect the circle in D. Lay off along along OD extended the line $DO'=b$. With O' as a center and with a radius equal to DO' construct a circle. From O' lay off in the direction of D the segment $O'C'=a$ and at C' erect a perpendicular to $O'C'$ cutting the circle, center O', in M' and N'.

Then $OQ=a$, and

$$iC'N'=i\sqrt{(O'N')^2-(O'C')^2}$$
$$=i\sqrt{b^2-a^2}.$$

Hence,

$$x=a\pm i\sqrt{b^2-a^2}=a\pm\sqrt{a^2-b^2}.$$

That is, the roots are given by $x=OQ\pm iC'N'$.

Note. It will be noticed that for the roots of the given equation $x^2-2ax+b^2=O$ to change from real roots to imaginary roots, it was necessary for $(CN)^2$ to change from a positive value to a negative value. This is accomplished by transforming CN through 90°, that is from the real plane of the circle center O, to the imaginary plane of the circle center O'. Hence the two circles lie in planes perpendicular to each other. Therefore OQ is measured in the plane of reals and $C'N'$ in the plane of imaginaries.

Method C. If Fig. 3 is used where PQ is oblique to OC', the equation may be

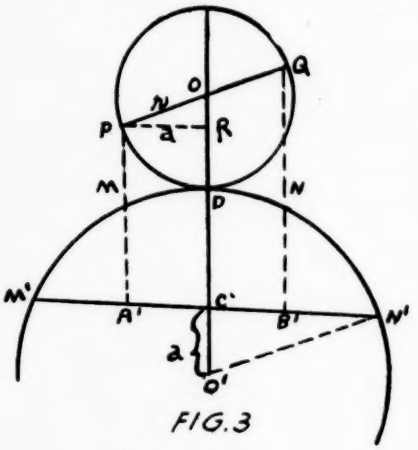


FIG. 3

written in the form $x^2-2ax+mn=O$ where $PR=a$, $m=PA'$, $n=QB'$, and

$$r=\sqrt{OR^2+PR^2}$$

$$=\sqrt{\left(\frac{M-N}{2}\right)^2+a^2}=OD=O'C'.$$

Also

$$O'N'=O'D=OC'=\tfrac{1}{2}(m+n).$$

Therefore

$$iC'N'=i\sqrt{(O'N')^2-(O'C')^2},$$

$$=i\sqrt{\tfrac{1}{4}(m+n)^2-\tfrac{1}{4}(m-n)^2-a^2},$$

$$=i\sqrt{mn-a^2}=\sqrt{a^2-mn}.$$

Therfore

$$x=C'B'\pm iC'N'=a\pm i\sqrt{mn-a^2},$$

$$=a\pm\sqrt{a^2-mn}.$$

Method D. Use of Equilateral Hyperbola.

If the roots are real they may be obtained by Method A. If the length b approaches the length a, CN decreases. For CN^2 to become negative it must be transformed through 180°. Hence CN must be transformed through 90°. This can be accomplished by substituting iCN for the CN of the circle, that is, by substituting iy for y in the equation of the circle. By this substitution, which transforms the figure from the real plane into the imaginary plane, we obtain

$$x^2+(iy)^2=a^2 \quad \text{or} \quad x^2-y^2=a^2$$

which is the equation of an equilateral hyperbola, lying in the imaginary plane and having the x-axis as its major axis.

Let $b=OC'$, Fig. 2. Then the desired roots are $OQ\pm iC'N'$.

Therefore

$$x=OQ\pm i\sqrt{b^2-a^2},$$

$$=a\pm\sqrt{a^2-b^2}.$$

In Method B, Fig. 1, it is readily proved that the points N' and M' lie on an equilateral hyperbola, having O as its center, and a as its semi-major axis.

Take OD and OQ, Fig. 2, as the axis of reference. Then $O'N'=b=OC'$, the abscissa of the point N'; and $C'N'$ is the ordinate of N'.

Hence $(O'N')-(C'N')^2=a^2$ or $x^2-y^2=a^2$ is an equilateral hyperbola having its center at O and one vertex at D.

Westinghouse Announces 1945 National Scholarship Contest

PLANS FOR the 1945 George Westinghouse Scholarship contest, open to every senior high school boy in the United States, were announced today by the Westinghouse Electric & Manufacturing Company, sponsor of the awards.

Ten scholarships, now valued at $1850 each, will be awarded for an engineering education at Carnegie Institute of Technology in Pittsburgh, according to J. C. McKeon, supervisor of scholarships and graduate study at Westinghouse.

Applications for the scholarships will be accepted only until February 1, 1945. Contestants are required to have good scholastic records in high school and be able to meet Carnegie Tech entrance requirements. Students who competed in the 1944 competition are not eligible for next year.

College Board Handles Tests

The tests will be administered in all parts of the country by the College Entrance Examination Board on April 7. Early in May the ten awards will be made and the winners will begin their studies at Carnegie Tech in June.

Much Ado About Mathematics

By Mrs. Freda S. Woolery
Garrison Junior High School, Baltimore, Maryland

Presented by: The Mathematics Department, Garrison Junior High School, Baltimore, Maryland

The play begins with an introductory speech delivered before the curtain.

There are five scenes and an epilogue so arranged that there is continuous action. The first scene is a living room, the third a shop room in a school and the fifth a radio broadcasting studio.

The second and fourth scenes are played before the curtain and provide ample time for the shifting of scenery behind the curtain. The epilogue takes place before the curtain.

There are two characters who appear in each scene, Robert, the boy, and the Wishing Genie. All other characters appear in but one scene.

Introductory Speech

We did not know what to call our performance so we borrowed three words from the title of the play, "Much Ado about Nothing" by William Shakespeare. He won't mind because he's dead, you know. We are calling this, "Much Ado about Mathematics."

The first scene takes place in the living room of the Garrison family. The next scenes skip blithely about our city. A magic hill top, a school shop, a city street and a radio studio will follow each other in quick succession.

When the curtain opens you will see John Garrison, doing something intensely interesting,—his algebra homework.

Scene I.

The living room in the Garrison home.

Characters

1. John Garrison, *the younger son.*
2. Mrs. Garrison, *his mother.*
3. John Garrison, Sr., *his father.*
4. Tom Garrison, *his older brother.*
5. Bill, *a friend.*
6. Carrie, *the colored maid.*
7. The Wishing Genie.

Scene I

As the curtain rises John is seen working at a desk

John: That doesn't work either.

(*He rises and crumples paper.*)

I just can't get that problem.

(*He hurls paper into waste basket, misses it and walks to retrieve it. On the way he spies a bow and arrow and begins fooling with it.*)

If I let go, I could shoot that algebra right off the table.

(*He puts down the bow and walks back toward the desk.*)

Maybe if I read it out loud, I can work it.

(*He reads.*)

"James, Charles and Allen together bought 70 defense stamps. James bought 4 more than twice as many as Allen. Charles bought 6 less than three times as many as Allen. How many stamps were bought by each?"

Let's see now. I'll let x equal somebody. Who? I tried Charles. It didn't work. Suppose I let x equal James. No. I tried that before. Well, here goes. Let x equal Allen's stamps.

$2x$ plus 4 equals James.

(*He gets up again and starts to walk from desk.*)

Gee whiz, I forgot Charlie.

(*He leans forward and writes.*)

$3x$ minus 6 equals Charlie, old boy.

Now what? I don't know. Who cares anyway as long as they buy the stamps.

(*He walks to the window.*)

Saturday afternoon. And here I sit fooling with X's and stamps. I wish I lived in a world that never heard of mathematics.

(*Lights go out. Noise like thunder is heard.*)

What's that? A blitz?

(*Lights come on almost immediately and the Genie stands before John.*)

Why, why,—who are you? The man from Mars?

GENIE: I am the Wishing Genie.

JOHN: Stop kidding. Genies went out of date when Aladdin lost his lamp.

GENIE: You may think so. Then, how do you think I got here?

JOHN: That's easy. You walked in.

GENIE: And who darkened the bright sunlight for my entrance?

JOHN: Oh, I guess a storm is coming up.

GENIE: Look. (*He points to window*) Does it look like a storm?

JOHN: (*Going to window*) No. It's bright. (*John turns to Genie.*)

No kidding now, old man, why did you come here? Are you a peddler?

GENIE: I came in answer to your wish.

JOHN: What wish?

GENIE: Yours. You wished that you might live in a world where there was no mathematics.

JOHN: Now, don't tell me that you are going to grant my wish?

GENIE: Yes. I am.

JOHN: You are? Wow! That's great.

GENIE: Of course, there are certain conditions.

JOHN: Conditions?

GENIE: If I grant your wish you must promise not to make use of mathematics or anything that owes its development to mathematics.

JOHN: That's easy.

(*Walks to table and places hand on algebra.*) I solemnly promise, swear, affirm, (*Rubs head*) and vow (*Turns ironically to Genie*). Is that strong enough? . . . that I shall deny myself the pleasure of your company from this time forth and forevermore.

GENIE: You are ready to give up algebra. Are you then willing to live in a world without any mathematics?

JOHN: No Mathematics! I promise. (*Holds up right hand.*) But, Genie? old dear, do not think I believe in you.

GENIE: Getting scared? Are you sport enough to go on with this bargain?

JOHN: Sure. I love sport. I promise I'll play your game.

GENIE: Good, Well then, here are the conditions. I shall be with you all the time. I shall be invisible to everyone but you. See this. (*He shows a metal cricket to John and clicks it.*) Whenever you are about to violate your promise, you will hear this.

JOHN: This is going to be fun. (*He walks to a chair to sit down.*)

GENIE: Click. Click. (*John jumps.*) You must not sit on a chair. See. (*Grasping chair and turning it.*) This chair is comfortable and well-balanced on four legs because it was measured. Geometry helped to build it.

JOHN: No chairs! Well. (*He sits on floor.*) this suits me. I always did have a yen for the oriental style of resting. I guess I'll brew a cup of tea. (*Mimics tea making and pouring and turning to Genie.*) Have a cup of tea, Rajah Genie.

GENIE: You are being very frivolous.

JOHN: Why not? It's a game, isn't it?

GENIE: No. I do not think so.

JOHN: Well now, let's talk. Mathematics didn't invent speech, or did it?

GENIE: No. You may converse on any subject but the subject must not be connected with mathematics in any way.

JOHN: (*Jumps up and goes to radio.*) Better still, let's listen to a speech on the radio. There's a game at Oriole Park and I want to know who's pitching.

GENIE: "Click. Click." You cannot turn on the radio. The dial has numbers.

JOHN: I'll close my eyes and get my station without your numbers.

GENIE: Stop! Do not touch it. That radio was made possible by engineers who had to employ mathematics.

JOHN: O.K. That's out. No chairs. No radio. Then let's talk about baseball.

GENIE: I'm afraid we can't. (*He takes a baseball from his pocket.*) This, as you can see, is a geometrical figure, a sphere. The diamond on which the game is played is measured. You keep score with the numbers of arithmetic.

JOHN: All right. No chairs. No radio. No baseball.

(*A call, "Yeah John," is heard back stage and Bill enters.*)

BILL: Say, come on. We're late.

(*Bill has a ball in his hand. He throws it to John, who is about to catch it, when the Genie sounds the cricket. John hastily drops the ball.*)

What's wrong, Butter-fingers?

JOHN: Can't a fellow miss once?

BILL: Skip it. Say aren't you going with us?

JOHN: I'm afraid I can't. I'm playing another game today.

BILL: Aw! Come on. The game's going to be a hot one. Sandy Gilmore, that semi-pro is going to pitch.

JOHN: He is! Gee whiz! (*He looks at Genie, who shakes head.*) Sorry, Bill, Not today.

BILL: Who'll we get to play third?

JOHN: Get Josh. He's better than I am, anyway.

(*A shrill whistle sounds back stage.*)

BILL: That's Josh now. Well, if you can't go, so long. (*Exit.*)

JOHN: So long. (*He goes to window to watch the boys.*)

GENIE: Too bad. No playing of baseball.

JOHN: Oh, well! I'm not such a big shot at that game.

GENIE: No!

JOHN: Now, let me see. What can I do? I have it. I can go swimming. The fish don't know mathematics.

GENIE: I agree with you there. You may swim but you cannot enter any of the competitve sports in water.

JOHN: This is getting more interesting. I can walk. I can sit on the ground. I can swim like a fish. And . . . dance.

(*He begins a dance.*)

GENIE: (*Click, click.*) No dancing (*Genie waltzes and counts one, two, three, one, two, three.*) See, John, we count.

JOHN: All right. I don't care. The girls walk all over my feet any way.

(*He spies the cookie jar and takes one.*)

Ha! Genie, I guess I got you now! I can eat these.

GENIE: Maybe.

JOHN: What do you mean, maybe! Carrie made these and I bet she never saw the inside of a math book.

GENIE: Call her in and ask her if she measured anything.

(*John calls, "Carrie, come here." Carrie enters.*)

CARRIE: What you all want?

JOHN: Carrie, did you make these?

CARRIE: Shore I did. It's a wonder der is any mohr lef wit you in dis yer room.

JOHN: Did you measure anything you put in them?

CARRIE: Did I? How you thinks I cook. I used one and half cups sugar, three quarter cup o milk, a hunk o butter, bout quarter pound, three eggs—

JOHN: That's enough, Carrie. I didn't think you knew so much arithmetic.

CARRIE: Rithmetic! Corse I knows rithmetic. How you thinks I cook?

JOHN: Well, don't get mad, Carrie.

CARRIE: Say, is dat all you wanted?

JOHN: Yes.

CARRIE: Lan sakes! You think I ain't got nothin to do but answer foolish questions. (*Exits.*)

(*John carries cookie back to jar.*)

JOHN: No cookies. So what do I eat?

GENIE: There's a nice apple tree in the garden.

JOHN: So I can go out in the garden and eat—nice green apples. This game is getting wild. Guess I better go out West with the Indians.

(*John grabs the bow and arrow, sings "Come let's play we're Indians" and grabs the Genie.*)

Come on, Big Chief Genie.

GENIE: Stop! I'll have no such disrespect. I think it is time to make you realize

how serious your promise to live in a world without mathematics is.

Let there be darkness!

(*The lights go off. John slips behind a screen and quickly throws a baggy costume over his street clothes. He removes his shoes.*)

GENIE: (*While John is changing, Genie speaks to audience.*) It is time to make this mortal realize he is not playing a game. I'll show him how he would look in a world without mathematics. His suit is measured and tailored. He must not wear it.

Ab bra ca da bra! Ab bra ca da bra!,
Punishment now to him I'll mete.
Change his clothes and bare his feet.
Ab bra ca da bra! Ab bra ca da bra!

(*Turns back to audience and faces rear of stage.*)

Let there be light.

(*Lights go on, revealing John in his costume.*)

JOHN: What, what,—What have you done to me?

GENIE: Dressed you like a barbarian who lives with no mathematics.

JOHN: This is awful. I can't see anybody like this.

GENIE: You must.

(*The bell rings.*)

There's your mother. Let her in.

JOHN: (*Exits.*) What a mess! (*Reenters with his mother.*)

MOTHER: Will you tell me what you're doing dressed like a savage? And where are your shoes?

JOHN: Mother, doesn't this make a good masquerade suit?

(*He grabs bow and arrow, posing.*)

MOTHER: It's awful. (*John now goes to the table where his mother has deposited a bag of groceries.*)

JOHN: You seem to have got a lot for your ration stamps, Mother.

MOTHER: Yes, because I planned my shopping ahead of time. You never saw such a scramble with these ration stamps. Do you know that Mrs. Smith on Barrington Rd.? Well, she had 7 cans in her basket and she only had enough stamps for 4. Was her face red when the clerk took them away from her! Serves her right. Why doesn't she learn to count!

JOHN: She better had.

MOTHER: I better get this stuff out to the kitchen. John, call Carrie.

(*John calls and Carrie enters.*)

CARRIE: For lans sake, John. What's you look like? I declare you looks worser than I does. What you want, Mis Garrison?

(*Carrie continues to stare at John and taps her head.*)

MOTHER: Carrie, take these out. John, is your father in?

(*The door bell rings.*)

JOHN: There he is now. I'll let him in.

MOTHER: Yes, let him in and then change those awful clothes.

(*Mother exits toward kitchen while John exits at other side. John's father enters followed by John.*)

FATHER: Am I in the right place? Are you my son?

JOHN: You mean this. (*Pointing to clothes.*) Just an idea for a comfortable summer costume.

FATHER: You better take it off before your mother sees you.

(*He picks up the paper.*)

H'm. Look at this!

JOHN: What is it?

FATHER: A picture of Bill Donovan, an old college mate of mine.

JOHN: What's he done?

FATHER: He's promoted to Lt. Col. of the Air Forces in the Solomons. I knew he was going places. Best engineer student in our class. That fellow was a wizard in mathematics.

JOHN: Gee! I wish I were in the Air Corps.

FATHER: Grow up first.

(*He takes the brief case, which he carried as he entered and starts toward exit.*)

JOHN: Aren't you going to play golf this afternoon? I thought I could caddy for you.

FATHER: No. I have some work to do. Those new clerks at the bank have snarled up these accounts. I'm going out to the

back porch and untangle their additions and subtractions.

(*As he nears the exit he turns to John.*)

I suppose your mother is out back. And, speaking of mother, you better change that costume of yours.

GENIE: Too bad your father has to waste a good afternoon correcting those mathematical errors of other folks.

JOHN: Yes, it is. Father should make them do it. They should not leave a job before it is done right.

GENIE: My sentiments exactly. Here comes your brother.

(*The genie looks out the window.*)

JOHN: Do you know him?

GENIE: I know everybody. I even know he works in one of the largest air-plane factories in the country.

JOHN: He's a test pilot. That's what I'm going to be.

GENIE: Aren't you going to let him in?

JOHN: He has a key.

(*Enter Tom.*)

TOM: Well, for the love of—Have I landed in the South Seas!

JOHN: What's wrong? Don't you like this outfit?

TOM: Are you trying to design a suit for a scarecrow?

(*Tom begins looking for his racket.*)

Say, I thought you were playing ball this afternoon.

(*Tom still searches.*)

JOHN: No, I changed my mind.

(*Genie steps up to John and whispers to him.*)

Tom, do you need much math to qualify as an air pilot?

TOM: Stop being funny, kid. The more math you know, the higher up you can go and I don't mean up in the air.

JOHN: Like Bill Donovan?

TOM: You said it. Say, have you seen my racket?

JOHN: Out in the closet in the hall.

TOM: Guess I'll go out back and see mother.

JOHN: Where are you going to play tennis? Jud's?

TOM: Yes. Want to come along?

GENIE: Click, Click.

JOHN: Nope.

GENIE: Sorry you made that bargain?

JOHN: I am a fool, sir. A big fool.

GENIE: That's the first time you have been respectful to me since I came to grant your wish.

JOHN: Oh! That awful wish! And that promise I made! Won't you release me from it?

GENIE: No. You are only worried about your clothes.

JOHN: No, I'm not. Can't you see I realize what a boob I've been?

GENIE: Realize it enough to sit down and work that problem you gave up?

JOHN: Oh, yes sir, yes sir!

(*John sits at desk and works.*)

TOM: (*Entering.*) Mother says you're to put on civilized clothes.

(*Tom exits.*)

JOHN: What do you think I'm doing? Oh! All right.

(*Genie wanders to radio and switches the dial.*)

VOICE OF RADIO: This is station, WEF. Attention, young men. Uncle Sam needs You. Have you had any technical training? Have you had any college course in mathematics? If so, go to your nearest recruiting station and volunteer. Go! Now!

(*The genie turns off radio.*)

JOHN: Eureka! It checks. I got it, Genie. Quick sir, change my clothes.

(*Genie takes the paper and looks at it.*)

GENIE: Yes, you have it.

JOHN: Come on, change my clothes.

GENIE: Very well. But, remember I have not released you from your promise. We are going places.

Let there be darkness. (*Lights out.*)

(*John goes behind the screen and throws off costume.*)

Ab bra ca da bra! Ab bra ca da bra!

Back with his measured and tailored suit.

(*Lights.*)

JOHN: Thank you, sir. But, you forgot my shoes.

(*Carrie enters, carrying John's shoes.*)

CARRIE: Your ma found dese under de apple tree and says you should put them on.

(*John sits and puts on shoes.*)

What is wrong wit you? Ain't you feeling good?

JOHN: Never felt better.

(*Carrie exits, shaking her head.*)

GENIE: Come, John, we must be on our way.

Curtain.

SCENE 2.

SCENE: *Before the curtain.*

CHARACTERS.

1. JOHN GARRISON.
2. THE WISHING GENIE.
3. MASTER OF MATHEMATICS. *Dressed in cap and gown.*
4. ARITHMETIC GIRLS. *Dressed in white play suits.*
5. GEOMETRY GIRLS (2). *One dressed in white, with plane figures covering dress; she may carry two solids. The other dressed in white with a protractor as a head piece; she may carry a carpenter's square.*
6. ALGEBRA GIRL. *She carries a scale on which cubes are placed. These represent numbers and x.*
7. TRIGONOMETRY BOY. *Dressed in surveyor's costume. Carries sextant.*
8. CALCULUS BOY. *Ordinary dress or soldier's uniform. Carries a large poster with a diagram of a problem.*
9. STATISTICS GIRL. *Ordinary dress. Carries a large notebook.*

Soft music.

JOHN: Do you hear music?

GENIE: Yes. It is a signal.

JOHN: Signal? Of what?

GENIE: I have asked some of the greatest forces in the development of our civilization to meet you.

(*Enter Master of Mathematics.*)

MASTER: I received your message and here I am. (*Shakes hand of genie.*) Ha! (*spying John*) Another mortal, come for enlightenment.

GENIE: Meet John Garrison.

MASTER: Delighted.

JOHN: But, who are you?

MASTER: I am the science of counting and measuring, The Master of Mathematics. Without me no other science can go very far. I want you to meet one of my branches.

(*He claps his hands. The ten girls enter. After they are in and facing the audience, the Master introduces them.*)

My basic branch.

(NOTE: *Girls do a drill which is given at the end of the script. After the girls march off, John speaks first.*)

JOHN: That must be arithmetic.

MASTER: (*Claps hands. Two geometry girls enter.*)

Can you guess this branch?

JOHN: That is geometry.

GE. FORM: I am Geometric Form. You will find me everywhere in everyday life. I am found in art and design, in buildings, bridges and constructions of all types. Without me the world would be shapeless.

GE. MEAS.: I am Geometric Measure. I determine size. I measure distances and directions by means of rulers, yard sticks and protractors. Without me the world would be like the crooked little man who lived in a crooked little house.

JOHN (*Aside to Genie.*): There wouldn't be any nice comfortable chairs, would there, Genie?

(*Algebra enters. She places the cubes on the scale while John moves closer to watch.*)

ALGEBRA: Now, that balances again.

JOHN: You're Algebra and that's the principle of the equation.

(*During the next speech the other three branches, trigonometry, calculus and statistics, enter.*)

ALGEBRA: Yes. The equation,—one of the mightiest tools in the solution of problems and formulas. By using letters and formulas I can say more in fewer words than any other language.

(*Algebra leaves and John watches the three others who are busy.*)

JOHN: Who are they?

GENIE: These are the higher branches.

MASTER: You cannot understand them until you have mastered the other three branches.

JOHN: What are . . .

MASTER: Watch and listen.

TRIG: (*Looking through transit.*) The angle of elevation is 22 degrees.

(*Calculus and Trigonometry consult a table.*)

CALC.: The curve of the projectile can now be determined.

(*Cal. draws a line on the poster.*)

STA.: Give me your reading so I can add it to my lists.

JOHN: Do you know what they are doing?

MASTER: Certainly. They are calculating the position of a gun for firing at a plane moving at 250 miles an hour.

JOHN: Who are they?

MASTER: I shall let them speak for themselves. Come here. (*He beckons to trigonometry.*) Tell this mortal who you are.

TRIG.: I am Trigonometry, the science that enables you to measure indirectly. You saw me working when I spotted that plane. By using the transit and these tables, I found the elevation of that plane.

JOHN: Isn't that marvelous. I guess you can measure the height of mountain ranges, too.

TRIG.: That is very simple.

JOHN: (*Turning to Calculus*) And who are you?

CAL.: I am Calculus. I am used by engineers in the designing of all large and important machinery in order to find out whether the machines will perform satisfactorily.

JOHN: I have heard that your branch is one of the most difficult.

CAL.: Not so difficult if you have a good foundation in the other branches.

JOHN: (*Turning to Statistics*) Won't you you tell me about yourself?

STA.: I discover and formulate relationships between variable quantities. I am useful with problems in business, economics and science. I apply my methods to data obtained by experiment or by observation.

JOHN: Imagine that. You cover some territory.

(*All exit but John and Genie*)

GENIE: Come, John, it is time for us to go.

JOHN: Yes sir. But, first I want to thank these friends of yours for their kindness. Why where are they?

GENIE: They are gone. You will find them in all parts of the world, anytime, anywhere, whenever counting and measuring are needed.

JOHN: And a mighty good thing it is to have their help. Are we going home now?

GENIE: No. Not yet. Come with me.

SCENE 3.

SCENE: *A shop room in a school.*

CHARACTERS.

1. JOHN GARRISON
2. THE WISHING GENIE
3. DAN
4. ED
5. FRANK
6. JIM
7. OTHER BOYS, *working on airplane models.*

JOHN: What's wrong? Is this a deaf and dumb school?

GENIE: No. Both of us are invisible.

JOHN: OH, gee whiz! Am I invisible? Could I go over and tap one of those fellows on the head without his knowing it?

GENIE: You are not here to play jokes. You are here to watch and learn.

JOHN: All right. No tricks. But, I know what those guys are doing. Working on airplane models. Why don't they do that during school hours?

GENIE: They haven't time. Do you know for whom they are making those models?

JOHN: No, sir.

GENIE: For the war department. They use these models in training camps. Our fighting men learn to recognize our planes and enemy planes by studying these models.

JOHN: I didn't know that. Guess I'll take a look around.

GENIE: Not so fast, young man. You're much too playful to turn loose as a spirit. (*The Genie places his hand on John's head.*)

Now, you are visible. Look, the instructor sees you.

INST.: Good afternoon. Come to join our boys?

JOHN: Good afternoon. No, I was passing and I wanted to know what was going on. Do you mind if I watch?

INST.: Not at all. Come with me. These two boys are pretty good workers. (*The boys look up.*) This is Dan and this is Ed.

JOHN: My name is John, John Garrison.

INST.: John came to find out what we're doing. Think you can take care of him?

BOYS: Yes, sir.

DAN: Look. (*Showing John a plane.*)

JOHN: Nice toy.

ED: Toy! My eye! This looks exactly like a real plane when it's flying a half-mile up.

JOHN: I still don't get it. How do the men in the camps use them?

DAN: You see it's like this. A soldier looks through the ring sight of an anti-aircraft gun (*Imitates the action*). There, flies a plane (*Pointing*) half a mile up. Now, if you put this model 35 feet away and look at it through the ringsight, it looks like the real thing.

JOHN: Oh! I see. But, how do you know how big to make them?

ED: The navy sends us the plans. We use a scale of one-sixth of an inch to the foot.

DAN: For every six feet of real plane we have one inch in the model.

JOHN: Where's the drawing of that plane you have?

ED: Come on over here and we'll show you two fellows working on it.

(*All move over to Frank and Jim.*)

DAN: Hey, Frank and Jim, this is John, I forget the other name. He thought we were making toys for Santa Claus.

BOYS: Hello.

ED: Show him the blue print. (*Dan and Ed go back to work.*)

FRANK: Here's the P-40 we're working on now.

JOHN: What do you do first?

JIM: We first cut out the rough form from the pattern. Then comes the tough part of the work.

JOHN: Seems to me that the fellow who makes the drawing has the tough job.

FRANK: You said it. They're the ones who have to calculate every single line and space.

ED: We'd be sunk without these plans. The fellows who make them have to be experts in mathematics.

(*Instructor has neared the group.*)

INST.: Boys, our whole war efforts would be sunk if it weren't for mathematics. Everything on a battleship or a bomber is done by calculation today.

JOHN: I know they use it for sighting airplanes.

FRANK: For dropping bombs, too.

INST.: You're both right. Without mathematics we could never have bombed Tokyo.

(*Genie beckons to John.*)

JOHN: Well, I have to push along. This has all been mighty interesting.

INST.: When you want to help, come and join us.

JOHN: I will, sir. (*Turning to boys.*) Thanks fellows, I'll be seeing you.

BOYS: So long.

JOHN: (*To instructor.*) Goodbye, and thanks a lot.

INST.: Goodbye. Come again.

Exit.

SCENE 4.

SCENE: *Before the curtain. A street.*

CHARACTERS.

1. JOHN GARRISON.

2. THE WISHING GENIE
3. THE RECRUITING SERGEANT
4. A WORKMAN
5. A YOUNG MAN
6. A WAC
7. TWO GIRLS, *who want to volunteer*
8. A YOUNG SCHOOL TEACHER

GENIE: Wait, here, outside this recruiting station and you will hear something to interest you.

JOHN: Look! There's a recruiting sergeant.

(*A workman enters carrying posters.*)

WORKM.: Hi, there Sarge. (*Turning to speak to the sergeant who follows.*) Got some beauties here. Just came in.

SERG.: They are good. But, you know what I wish they'd send us?

WORKM.: What?

SERG.: A big poster to all the questions they ask all day long. (*Mimics.*) Can I join the Air Corps? What do I need to be recommended to Officer's Training School? Where . . .

(*This question is interrupted by WAC officer.*)

WAC: That's what I would like to have, too. The girls all come in thinking that all they have to do is look pretty and write a letter.

(*WAC leaves and Young Man enters.*)

YOU. M.: Are you the recruiting sergeant?

SERG.: Yes, I am. What can I do for you? Won't you come inside?

YOU. M.: No. I only want to ask you what I have to know to get into the Air Corps.

SERG.: Well, you know you have to take a test.

YOU. M.: Yeah. What kind of questions?

SERG.: They are on all kinds of subjects but most of them deal with technical things. You know the more math you know, the better your chance of passing. Now, here's a little book put out by the War Department. It's a technical manual, "Mathematics for Pilot Trainees." It starts out with addition, subtraction, multiplication and division of decimals. The next part is changing common fractions to decimal fractions. Can you express 5/8 as a decimal?

YOU. M.: Certainly. 5/8 equals 62 1/2 hundredths.

SERG.: How about 7/12?

YOU. M.: Umm—I'll need a pencil. You divide 7 by 12.

SERG.: It's all worked out here on page 18. Here's a subtraction of fractions: 9/11 minus 6/11.

YOU. M.: That's a cinch. 3/11.

SERG.: Do this. Got paper and pencil. 7 2/3 plus 8 3/4 plus 11 1/2.

(*John has come closer.*)

You're not interested in joining up, are you?

JOHN: You bet I am, but I'm only 14.

YOU. M.: I got the answer. It's 28 11/12.

SERG.: That's right.

JOHN: I can do all those examples.

SERG.: It isn't all arithmetic. There's algebra, too. Here's a section on positive and negative numbers.

YOU. M.: I remember them.

SERG.: The next chapter is "Equations and Formulas." Did you ever hear this: C equals 5/9 $(F-32)$.

YOU. M.: I remember that from Garrison Jr. High. It's the formula used to change from Fahrenheit to Centigrade.

SERG.: That's O.K. What about problems? Think you can answer this? A soldier walked 15 miles and then returned immediately in a Jeep which averaged 45 M.P.H. The entire trip required 4 hours and 5 minutes. Find the soldier's average rate of walking.

(*A bell rings.*)

There's the telephone. Come in and I'll show you the rest of the book.

(*Exit, Sergeant and Young Man.*)

JOHN: Genie, can you answer that jeep question?

GENIE: Certainly. The answer is 4 miles.

JOHN: How did you do it?

GENIE: Algebra. Do you still think algebra is so useless?

JOHN: No, sir. I know now that I need

it if I'm going to be a pilot. (*Two girls enter.*)

1ST GL.: What do you think of that test?

2ND GL.: Too much math to suit me. I bet I flunked it.

1ST GL.: In that division of decimals I didn't know where to put the decimal point. I wish I had paid more attention to math when I went to school.

(*Girls exit. Another girl follows in their footsteps and exits without speaking.*)

GENIE: See that young lady. She didn't have any trouble with her tests.

JOHN: Why?

GENIE: She was a teacher of mathematics.

JOHN: I guess the test was a cinch to her.

GENIE: Now, let us go. I think you are thoroughly conviced of the importance of mathematics.

JOHN: I am, sir, but it seems to me it's all work. No fun.

GENIE: No fun. I see I cannot yet leave you. My work is not completed.

JOHN: Completed? I don't understand.

GENIE: I have yet to show you that you can enjoy mathematics, so come along.

Exit.

SCENE 5.

SCENE: *A radio studio.*

CHARACTERS.

1. JOHN GARRISON
2. THE WISHING GENIE
3. BENJAMIN WOLF
4. MARY KESSLER
5. USHER
6. JANE
7. THE SINGER
8. DR. QUESTION MARK
9. ANNOUNCER.

Contestants and spectators walk in and are seated. The announcer bustles about placing the loud speaker in position. To one side are three chairs for the contestants.

(*Enter Mary and Jane.*)

MARY: Well, what do you know about that ! I drew a ticket. How do I look? Is my hair all right?

JANE: Don't worry about your hair. That won't win you stamps. It's what's in your head that counts.

MARY: I know I'll forget everything when I get up there.

(*Usher conducts Mary to the three chairs, where Ben is already seated. John and the Genie enter. The Genie remains back of spectators.*)

USHER: Did you draw a ticket?

JOHN: You mean this?

USHER: Please sit here.

JOHN: What goes on here?

BEN: We three are going to answer questions and win stamps. Maybe.

ANNOUNCER: Good afternoon. You are listening to Sta. WBL. Before beginning our weekly battle today, we are going to have the privilege of listening to one of our foremost radio personalities: Miss Ivy Mores.

(*Song: Johnny Got a Zero.*)

Thank you Miss Mores.

We are about to hold our 50th battle of the season. All contestants, as you know, have been impartially chosen from the pupils of our city schools. Each will be given 4 questions on general subjects. If they answer these correctly 100 points will be added to the score of the schools they represent. After this round there will be a bonus question, which, if answered correctly will be rewarded by a gift of 10 War Stamps. If the contestant misses the bonus question, he passes his stamps to the ones who answered correctly.

ANNOU.: In charge of this session we have the great questioner, the ever-interrogating, the one who asked his teacher the most questions when he went to school—the one-and-only Dr. Question Mark.

(*Applause in studio.*)

DR.: Thank you boys and girls. Now, are the contestants ready?

USHER: Here, sir, is the first contestant.

DR.: What is your name?

BEN.: Benjamin Wolf.

DR.: From what school?

BEN.: City College.

DR.: Are you ready to give us four correct answers?

BEN.: I'll give four answers, but if they are like some answers I give on my test papers—Oh, My!

DR.: Here is your first question: Who was in command of the raid on Tokyo?

BEN.: James Doolittle.

DR.: Correct. Who was Pythagoras?

BEN.: I should know that. Was he a poet?

DR.: He was a Greek philosopher and mathematician.

BEN.: I know now. He gave us the Pythagorean theory of triangles.

DR.: Yes, he did. But, I shall have to count that wrong. Your next question: Where is the Eustachian tube?

BEN.: Never heard of it. Is it in New York?

DR.: No. It is a tube connecting your inner ear with your throat. Now, for your fourth question: Is the cube a plane or a solid?

BEN.: Solid.

DR.: Correct. Well Ben, you have scored 50 points for the Senior High School Division.

(*Usher leads Mary to the microphone.*)

What is your name?

MARY: Mary Kessler. I'm in the sixth grade.

DR.: What school?

MARY: Number 69.

DR.: Let me see. Your questions will come from this set. Are you going to give us four correct answers?

MARY: I'll try. I'd like to fill my stamp book.

DR.: Who is the officer in charge of the WAC.?

MARY: Mrs. Roosevelt.

DR.: No. Mrs. Hobby. Don't be discouraged. You have three more trials. What color of stamp does your mother use when she buys meat at the store?

MARY: Red.

DR.: What is the lower number of a fraction called?

MARY: Num—no—yes it is—numerator.

DR.: No. It's the other one, denominator. That always puzzled me when I went to school.

MARY: I had that in a test last week.

DR.: Too bad. Well here's an easy one. What will three two-cent stamps and two three-cent stamps cost?

MARY: (*Counting on fingers*) 12 cents.

DR. That is right. You have scored, let me see, 50 points for the elementary schools.

(*Mary takes her place and John comes forward.*)

What is your name?

JOHN: John Garrison.

DR.: What school do you represent?

JOHN: Garrison Junior High School.

DR.: John Garrison from Garrison. Were you named for the school or did they name the school for you?

JOHN: They won't ever name any place for me.

DR.: Who knows. You might some day be president. Now, here is your first question: Who is Commander-in-chief of the United States Army?

JOHN: General Eisenhower.

DR.: No. What instrument does a surveyor use to measure angles?

JOHN: A transit. I saw one this afternoon.

DR.: Who was Archimedes? Ever hear of him?

JOHN: Is he another general in the army?

DR.: No, he was another Greek mathematician. He loved circles. Now for your fourth question. You'll have to get this right to even the score with the other schools. How many feet are in a half mile?

JOHN: Two thousand—six—hundred and—forty feet.

DR.: That is correct. You have given the Junior High School Division 50 points.

(*John moves back to his seat.*)

Stay here. Will the other two contestants please step forward?

(*The other two come forward.*)

Now I am going to give you the bonus question. The usher will give each of you a

pencil, a card and 10 defense stamps. If you write the correct answer to the bonus question on your card, you may keep the stamps. If one of you misses, he must divide his stamps, giving each of the other two, 5 stamps. If only one of you answers correctly, he will receive all of the stamps —30 in all.

Ready. I shall read the question once.

"Tom went to the barn to fetch the eggs. On the way back he stumbled and fell breaking one-third of the eggs. When he got to the house, his little sister bumped into him and broke one-half the remaining eggs. He now had 4 eggs left. How many did he have at first?

No coaching. (*Spectators whisper.*)

Time is up.

Mary, you wrote 16. You missed it.

Ben, your card is blank.

BEN.: My mind went broke, like the eggs.

DR.: John, you have 12. That is correct. Begin collecting.

JOHN: Genie, Genie, where is he?

BEN.: You mean Genie, with the light brown hair?

DR.: What's wrong John?

JOHN: I can't believe it. I won a contest in mathematics.

Curtain.

EPILOGUE.

Before the curtain.

The Genie walks slowly across the front of the stage.

JOHN: (*Following*) Genie, I won.

GENIE: Yes, I know. Now I must say goodbye.

JOHN: Are you leaving me?

GENIE: Yes, my work with you is done.

JOHN: Goodbye and thank you, sir. I want you to know, I've learned my lesson. Mathematics, from this time on, and I are like that. (*Holding up two fingers crossed.*)

(*Turning to audience and forming V with his fingers.*) Mathematics for Victory.

ARITHMETIC DRILL

Ten girls are dressed in white playsuits and white flat hats. The hats are made from round paper plates around which a red, white and blue border is painted. Each hat has a number from one to zero painted on the top in black. The hat is fastened by two ribbons, passing through perforations in its top.

On the back of each girl is pinned a square of white goods on which is painted another symbol used in arithmetic.

Each girl carries another paper plate, one side of which has a red border and the other side a blue border. A number or a symbol is painted in black on each side of the plate.

The following diagram shows what symbols each girl wears and what appears on each side of the plate she carries.

Number on hat	Symbol on back	Red-bordered side of plate	Blue-bordered side
1.	+	6	2
2.	−	+	=
3.	×	2	3
4.	÷	=	÷
5.	=	8	6
6.	. (dec. pt.)	4	8
7.	√	−	=
8.	%	3	4
9.	π	=	×
0.	∞	1	2

The girls march in to music, single file, holding a plate in the left hand and saluting with the right. The leader gives the signal. "Face" and the girls turn to the audience. The Master of Mathematics introduces them with, "My basic branch." Thereupon each girl takes a low bow as she calls the number on her hat. The girls hold the bowed position until all numbers from one to zero are revealed.

Upon the signal, "Up" all stand upright.

The leader then calls, "Our Other Symbols." Each girl calls the symbol on her back and jumps making a half turn.

"About Face." The girls turn and face the audience.

"Separate." The girls from one to five move sideward with small steps while the girls from six to zero move in like manner but in the opposite direction. There should be a gap of about three feet between the groups.

"Operate." Each girl in turn raises the plate with the red border showing to her chest as she calls the symbol on it. The plates will show an addition and a subtraction combination.

"Change." Music is played. The first girl changes places with the tenth girl, the second girl with the ninth, etc. until each one has changed places.

"Operate." The girls now display the blue-bordered side of the plates. The result will be an example in multiplication and one in division.

"Face." The girls make a quarter turn, salute as they pass the Master of Mathematics and make their exit. As they near the side of the stage and just before leaving each two girls bow low to the audience and reveal a number of two digits on their hats.

The March of Dimes

LAST YEAR more than 50,000,000 Americans joined one of the world's largest fraternal organizations, The National Foundation for Infantile Paralysis, by contributing their dimes and dollars to the March of Dimes. The power of their combined "dues," contributed voluntarily each year, is now giving infantile paralysis victims all over the country the best care that medical science offers today.

Last year thousands of names were added to the long polio casualty list. Epidemic proportions were reached in New York, North Carolina and Kentucky. Tennessee, Virginia, Maryland, Pennsylvania, Ohio Michigan, Indiana, Louisiana, Mississippi, Illinois, Connecticut, New Jersey, and the District of Columbia were hard hit. In these stricken areas, representatives of the National Foundation worked unceasingly with state and local authorities to provide emergency aid, professional workers, supplies and equipment. In this direct way were "benefits" returned to the members, the American people, who founded and maintain the National Foundation through their contributions to the Annual Fund-Raising Appeals, points out Basil O'Connor, president of the National Foundation.

Funds raised through the 1945 March of Dimes, January 14–31, will be used to provide continued treatment for 1944 victims of polio and victims of previous years. They will also serve as a bulwark of defense against any 1945 invasion of this home-front enemy. Fifty per cent of each contribution is retained in the county where it was provided; the other 50 per cent will be working to further the National Foundation's program of research, epidemic aid and education. Keep America strong—send your dimes and dollars to The White House.

◆ THE ART OF TEACHING ◆

A Technique for Teaching Subtraction of Signed Numbers

By W. E. Romig
William Penn High School, Harrisburg, Pa.

One of the chief obstacles in the way of teaching subtraction of signed numbers is the difficulty of leading the pupil to a proper conception of "opposites." This difficulty arises, no doubt, from the fact that there are two different conceptions of opposition involved in algebraic subtraction, (1) opposition of value, and (2) opposition of operation.

The pupil is introduced to the first of these conceptions in the addition of signed numbers, and it is usually grasped quite readily, for it is easy to illustrate by concrete examples (temperature reading, card game scores, debits and credits, etc.) that positive numbers are those with value greater than zero and negative numbers are those with values less than zero. But the second conception is purely a mathematical abstraction, and it is doubtful whether many secondary pupils ever clearly understand that the operation of subtraction is the *opposite* of the operation of addition.

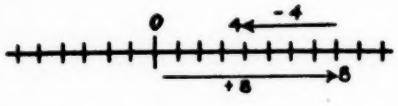
The attempt to teach algebraic subtraction by rule, therefore, usually meets with little success, because the pupil has no proper conception of the logic back of the rule. A technique for building the proper mathematical idea is as follows:

Suppose that the pupil has mastered the process of algebraic addition so that he can add correctly such combinations as the following:

+8	+8	−8	−8
+4	−4	+4	−4

Suppose further that he has learned to add these numbers graphically, thus; Add

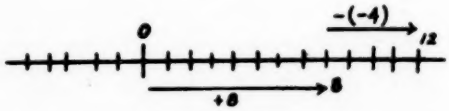
+8
−4



The pupil has been taught to reason, "Starting at zero I count eight units to the right (up) because the sign of 8 is plus, and then four units to the left (down) because the sign of 4 is minus. This places me four units to the right of (above) zero, therefore the sum of +8 and −4 is +4."

When the pupil has mastered this process, he is ready to begin subtraction. Explain that the *operation* of subtraction is the *opposite* of the *operation* of addition, and numbers to be subtracted must be counted *in the direction opposite to that in which they would be counted for addition*, thus: Subtract

+8
−4



"Starting at zero I count 8 units to the right because the sign of 8 is plus. If I were adding, I would count 4 units *to the left* because the sign of 4 is minus, but since I am subtracting I must count 4 units *to the right, opposite to the direction for addition.* This places me twelve units to the right of zero; the difference of +8 and −4 is +12."

After the pupil has thoroughly mastered this graphical process (and not until then) he should be shown that the same results can be obtained algebraically by "changing the sign of the subtrahend, and proceeding as in addition."

EDITORIALS

How to Build a New Curriculum

IT SEEMS to be the vogue just now for college teachers of mathematics to discuss the type of mathematics course that should be offered in the first year of college. If one consults the literature,[1] it seems clear that much of the content material offered in articles, outlines, textbooks and even in discussions at professional meetings is strictly high school mathematics. This fact may be due to necessity and to conditions over which some of us at least may have had no control. But it does seem to be clear that it is about time for The National Council of Teachers of Mathematics, The Mathematical Association of America and any others concerned, to study the situation carefully and see whether the present way of handling the situation is not only not the wisest plan, but entirely too expensive.

There are plenty of places in this country where college instructors are able to do little or no work in real college mathematics, which certainly is not exactly what most of them would prefer. Moreover, in the case of certain state financed institutions, the state is paying an enormous price to teach material that could have been as well, and in some cases, even better taught to the boys and girls in their respective high schools back home. In many cases it would be even cheaper and better to plan for such work in the local community through some kind of junior college organization, if that is feasible. Such a plan would keep many boys and girls at home two years longer and would not involve such financial sacrifice by their parents.

There is another difficulty that arises whenever any group at some one level in the schools digs in, so to speak, and tries to revamp a year or two of the prescribed material. Such organization should be more fundamental. It should begin down in the grades and the curriculum should be reorganized from the bottom up, not from the top down. Perhaps the new *Commission on Post-War Plans* in mathematics will have time to consider this problem.

If high school mathematics is worth teaching, then why isn't it better to teach it in high school, where it belongs. This does not mean that all of the mathematics offered in the typical four-year high school should be required, but it should be made available there and it should be adapted to the individual needs and differences among those who elect to study the subject.

W. D. R.

[1] See Brink, R. W., "College Mathematics During Reconstruction." *American Mathematical Monthly*, February 1944, pp. 61–74.

Brown, Kenneth E., *General Mathematics in American Colleges*. Teachers College, Columbia University, Contributions to Education, No. 893. Bureau of Publications, Teachers College, Columbia University, New York City.

Evans, H. P., "Mathematics Textbooks for the Introductory College Courses". *The American Mathematical Monthly*, January 1944, pp. 12–18.

Hennelly, R. J., "Mathematics in the Junior College." *The American Mathematical Monthly*, November 1939. Part I, pp. 581–585.

Ore, Oystein, "Mathematics for Students of the Humanities." *The American Mathematical Monthly*, October 1944, pp. 453–458.

The Need for More Subscribers

IN A RECENT article Professor Withers[1] said, "Two associated and regrettable conditions prevalent among teachers from the lowest institutions to the highest, are narrowness of reading and failure to support essential professional magazines.

Few people would question the truth of

[1] Withers, A. M. "Let's Be Better Subscribers." *School and Society*, December 2, 1944, pp. 365–367.

this statement. In fact the situation is often worse. Some teachers do not even subscribe to the magazine that is closest to their field, or fields of specialization, to say nothing of the more general magazines. Professor Withers thinks that, "A teacher in high school, college or university should not only subscribe to journals connected with his own specialization, but should go as far as he possibly can beyond that sphere." He then raises the question as to why a teacher will spend as much money as he does on travel and trips to professional meetings, while at the same time he neglects to support the publications which voice the best thought and and furnish the most complete information and stimulation in his and other related fields.

We think that mathematics teachers who are in the class described by Professor Withers could render a great service not only to themselves, but also to The National Council of Teachers of Mathematics, by subscribing for THE MATHEMATICS TEACHER regularly. Perhaps there are some mathematics teachers in this country who still do not know that there is such a journal as THE MATHEMATICS TEACHER. We know that as far as some are concerned The National Council of Teachers of Mathematics is non-existent. However, with the fine group of State Representatives[2] which the Council now has, most teachers should be informed about the organization, its official journal, the yearbooks and important committees, such as the new *Committee on Post-War Plans* in Mathematics.

But it is not enough to leave all of the pioneering to the State Representatives, whose work is a labor of love. We must all be boosters.

Again, it may be necessary and important that mathematics teachers read the official journal and the yearbooks; but that is not sufficient. If we were all like that, the Council would at once cease to function. We often get a letter from some teacher who informs us that he is dropping his subscription to the journal because his high school library has taken out a subscription. This is all well and good, but it means a loss to the Council. No organization can be strong unless it has the support of a majority of its potential members. A letter that has just reached us from Reino M. Fakala, of the Shorewood High School, in Milwaukee, Wisconsin illustrates the spirit we need. It says, "The school subscribes to THE MATHEMATICS TEACHER for the whole mathematics department, but I have found that under this system it is sometimes inconvenient to get the copies when one most needs them. Therefore, I would like to have copies to keep in my personal library of professional literature. I am enclosing my check, etc."

In the days ahead, teachers must back up the Council by their financial support if they want it to continue to fight their battles and help them to improve the situation in the post-war world. Here's hoping that we may be deluged with a large number of renewals and new subscriptions.

W. D. R.

[2] See the latest official list of State Representatives of the National Council on page 40.

Mathematics Posters

THE Women's Mathematics Club of Chicago recently had a contest among the Chicago high school students for the best posters made by students on the importance and uses of mathematics. These were shown in a number of places in and around Chicago. Then the Club gave them to the Public Relations Committee of The National Council of Teachers of Mathematics. Any school asking to borrow these posters should guarantee to pay the express on the posters to and from Racine, Wisconsin. Address Miss Mary Potter, Board of Education, City Hall, Racine, Wisconsin.

W. D. R.

IN OTHER PERIODICALS

By NATHAN LAZAR
Midwood High School, Brooklyn 10, New York

American Mathematical Monthly

October 1944, Vol. 51, No. 8

1. Higgins, T. J., "Biographies and Collected Works of Mathematicians," pp. 433–445.
2. Frame, J. J., "Tangent Triangles to a Biquadratic Curve," pp. 445–450.
3. Riordan, John, "Three-Line Latin Rectangles," pp. 450–452.
4. Ore, Oystein, "Mathematics for Students of the Humanities," pp. 453–458.
5. Fort, Tomlinson, "The Method of Undetermined Coefficients," pp. 462–464.
6. Smiley, M. F., "On My Proof of the Budan-Foureier Theorem," p. 465.
7. Wilensky, Michael, "A Representative of Integers," pp. 466–468.
8. War Information: The Asbury Park Pre-V-12 Program; Recircularization of Registrants in the National Roster; The Section on Education in the G. I. Bill.

Bulletin of the Kansas Association of Teachers of Mathematics.

October 1944, Vol. 19, No. 1.

1. Holroyd, Ina E., "Random Thoughts on Teaching Secondary Mathematics," pp. 3–8.
2. "K.A.T.M. Seeks Cooperation of Principals; Their Suggestions Asked for," p. 9.
3. Zimmerman, Iva, "Suggestions on the Teaching of Graphs in the Seventh Grade," p. 11.
4. "Morton's Criticism of the Incidental-Learning Theory," pp. 11–13.
5. "Wichita Plane Geometry Outline," pp. 13–14.
6. "A Check List for Pre-Induction Mathematics," pp. 14–15.

School Science and Mathematics

November 1944, Vol. 44, No. 8.

1. Georges, J. S., "Another Approximate Trisection Method," p. 690.
2. Struyk, Adrian, "The Fibonnaci Numbers," pp. 701–707.
3. Strehler, Allen Frederick, "Can Your Students *Talk* Mathematics?" pp. 714–716.
4. Johnson, J. T., "The Metric System," pp. 717–721.
5. Painter, Donald H., "Clear as a Bell," pp. 722–723.

Miscellaneous

1. Bagley, W. C., "Present and Future of Latin and Mathematics in Secondary Education," *School and Society*, 60: 259–260, October 21, 1944.
2. Brownell, W. A., "Essential Mathematics for Minimum Army Needs," *School Review*, 52: 484–492, October, 1944.
3. Coulter, J. O., "Mathematical Literacy," *School* (Elementary Edition), 33: 147–151, October, 1944.
4. DeMay, A. J., "First Steps in Arithmetic," *Instructor*, 53: 28–29+, October, 1944.
5. Guiler, W. S., "Forecasting Achievement in Elementary Algebra," *Journal of Educational Research*, 38: 25–33, September, 1944.
6. Van Engen, H., "Handbook for Arithmetic," *Midland Schools*, 59: 31–33, September, 1944.
7. Wren, F. L., "This Is the Case for Mathematics; Reply to P. S. Blumberg," *Clearing House*, 19: 10–13, September, 1944.

Regional Meeting of the National Council of Teachers of Mathematics!

THE Board of Directors of the National Council of Teachers of Mathematics will meet at the Statler Hotel in Cleveland, Ohio, on Friday, February 23. On Saturday, February 24, the National Council will have a regional meeting with the following general program:

SATURDAY A.M.

Four Sessions as follows:

1. Mathematics in the Elementary School
2. Mathematics in the Junior High School
3. Mathematics in the Senior High School
4. Mathematics in the Junior College

NOON: LUNCHEON

SATURDAY P.M.

General Session

Report from the Commission on Post-War Plans

Consult the February issue of THE MATHEMATICS TEACHER for the final program.

State Representatives of the National Council of Teachers of Mathematics*

Alabama: Mr. J. Eli Allen, Phillips High School, Birmingham.
Arizona: Miss Myra R. Downs, 93 West Culver St., Phoenix.
Arkansas: Miss Elizabeth McHenry, 1702 Battery St., Little Rock.
California: Mrs. Ruth G. Sumner, Oakland High School, Oakland.
Colorado: Mr. H. W. Charlesworth, East High School, Denver.
Connecticut: Miss Marion Sharman Hancock, Box 180, Westville Ave., Extension Danbury.
Delaware: To be filled.
Dist. of Col.: Mrs. Ethel Harris Grubbs, 751 Fairmont St., Washington, D.C., and Miss Veryl Schult, Wardman Park Hotel, Washington, D. C.
Florida: Dr. F. W. Kokomoor, University of Florida, Gainesville.
Georgia: Miss Bess Patton, 1585 N. Decatur Rd., N. E. Atlanta.
Idaho: To be filled.
Illinois: Dr. Miles Hartley, University High School, Urbana.
Indiana: Dr. L. H. Whitcraft, Ball State Teachers College, Muncie.
Iowa: Miss Dora Kearney, Iowa State Teachers College, Cedar Falls.
Kansas: Miss Ina Holroyd, Kansas State College, Manhattan.
Kentucky: Miss Dawn Gilbert, 1331 Clay St., Bowling Green.
Louisiana: Miss Jessie May Hoag, Jennings High School, Box 837, Jennings.
Maine: Miss Pauline Herring, 360 Spring St., Portland.
Maryland: Miss Agnes Herbert, 806 E. North Ave., Baltimore.
Massachusetts: Mr. Harold B. Garland, 129 Houston Ave., Milton.
Michigan: Mr. Duncan A. S. Pirie, 950 Selden Ave., Detroit.
Minnesota: Miss Edna M. Norskog, 322 Fourth Avenue East, Alexandria.
Mississippi: Mr. Dewey S. Dearman, State Teachers College, Hattiesburg.
Missouri: Mr. G. H. Jamison, State Teachers College, Kirksville.
Montana: Miss Gertrude Clark, 403 Eddy Ave., Missoula.

*** The State Representatives of The National Council whose names appear on this page are doing excellent work for the Council. It is hoped that teachers of mathematics all over the country will cooperate with them in their respective localities in order that our membership may be appreciably increased.—The Editor.**

Nebraska: Dr. A. R. Congdon, University of Nebraska, Lincoln.
Nevada: Mr. R. van der Smissen, White Pine County High School, Ely.
New Hampshire: Mr. H. Gray Funkhouser, Phillips Exeter Academy, Exeter.
New Jersey: Miss Mary C. Rogers, 425 Baker Ave., Westfield.
New Mexico: Professor W. P. Heinzman, Dept. of Mathematics, New Mexico College of Agriculture and Mechanic Arts, State College.
New York: Mr. H. C. Taylor, Benjamin Franklin High School, Rochester.
North Carolina: Professor H. F. Munch, Chapel Hill.
North Dakota: Miss Henrietta L. Brudos, State Teachers College, Valley City.
Ohio: Mrs. Florence Brooks Miller, 3295 Avalon Road, Shaker Heights and Mr. J. V. Mangle, 1541 Maple Ave., Wyoming.
Oklahoma: Miss Eunice Lewis, 2203 East 14th St., Tulsa.
Oregon: Miss Sarah Ruby, 1509 N.E. 10th Ave., Portland 12.
Pennsylvania: Dr. Lee Boyer, State Teachers College, Millersville.
Rhode Island: Mr. M. L. Herman, Moses Brown School, Providence.
South Carolina: Miss Harriet Herbert, University of South Carolina, Columbia.
South Dakota: Miss Josephine Wagner, Sioux Falls Schools, Sioux Falls.
Tennessee: Mr. R. C. Shasteen, Clarksville.
Texas: Miss Elizabeth Dice, North Dallas High School, Dallas.
Utah: Mr. R. B. Thompson, University of Utah, Salt Lake City.
Vermont: Mr. John G. Bowker, Middlebury College, Middlebury.
Virginia: Miss Carrie B. Taliaferro, Box 102, State Teachers College, Farmville.
Washington: To be filled.
West Virginia: Miss Mary L. Wilt, 107 High St., Morgantown.
Wisconsin: Miss Theda Frances Howe, Riverside High School, Milwaukee.
Wyoming: Dr. O. H. Rechard, University of Wyoming, Laramie.

Canada

Alberta: Professor A. J. Cook, University of Alberta, Edmonton.
Manitoba: Mr. D. McLeod, 716 Ingersoll St., Winnipeg.
Nova Scotia: Mr. Warren G. Roome, Amherst Public Schools, Amherst.
Porto Rico: Miss Conchita R. de Lopez, Universidad de Puerto Rico. Rio Piedras.

NEWS NOTES

Dr. Rolland R. Smith addressed the Rhode Island Mathematics Teachers' Association meeting with the Rhode Island Institute of Instruction at their Fall meeting in Providence on Friday, October 27 on the topic "The Future of Mathematics in Our Schools."

The Connecticut Mathematics Teachers held meetings on Friday, October 27 in Bridgeport, Hartford and New Haven.

At the Bridgeport meeting Ward Satterlee of Greenwich was the Chairman of the Arithmetic Section and leader of the Round Table. Other members of the Round Table were Helen Barr, Stratford; Angeline Wakeman, Norwalk; and Magda Schoefield, Norwalk. Susie Farmer of Bridgeport was the chairman of the Mathematics Section.

At Hartford the topic was "Redirections in Mathematics" and the following questions were considered:

1. Are we satisfied with the present organization and sequence of courses in mathematics?
2. How much emphasis should be placed on mathematics in post-war education?
3. Should the utilitarian aspects of mathematics receive greater emphasis? Harriet Weatherbee of East Hartford was chairman of the meeting and David Reichgott of the New Haven High School was the speaker.

At New Haven, Henry Farrington of the New Haven High School was the chairman. Dr. Nathan Lazar of the Midwood High School, in Brooklyn, N. Y. spoke on the topic "What Is Wrong with the Courses of Study in Algebra and Geometry?"

Minutes of the Meeting of the Commission on Post War Plans of the National Council of Teachers of Mathematics Held at the Hotel Sheraton, Washington, D. C., October 21–22, 1944

The Commission convened at 10 A.M., Saturday, October 21. Meetings were held throughout Saturday and Sunday. Those present were Raleigh Schorling (Chairman), William Betz, Virgil S. Mallory, Rolland R. Smith, and F. Lynwood Wren. Dr. Eugenie Hausle was unable to attend.

I. The Commission passed the following motions:

1. In accordance with the authority delegated to the Commission by the Board of Directors of the National Council of Teachers of Mathematics, the membership of this Commission shall be increased to include any official representative of a unit of the National Council of Teachers of Mathematics (city, county, or state organization of teachers of mathematics), provided that the new member agrees to attend at least one meeting of the Commission during the year, provided further that the expenses incurred by such attendance are paid by the local organization.
2. The Policy Commission heartily endorses the report of the special committee appointed at the invitation of the United States Commissioner of Education, Dr. John W. Studebaker, on possible furtherance of plans relating to proposed services to classroom teachers of mathematics by the United States Office of Education.
3. It is recommended that if and when the Cooperative Committee on the Teaching of Science and Mathematics is constituted so as to be a permanent committee financed by parent organizations, the Board of Directors of the National Council of Teachers of Mathematics consider the feasibility and advisability of participating in that undertaking.
4. An Arithmetic Committee, such as that which functioned in the making of the arithmetic yearbooks, be constituted and encouraged to furnish a yearbook at least once in every five years.

II. It is the belief of the Commission that the National Council of Teachers of Mathematics needs to amend its constitution so as to broaden its scope and recognize its responsibility for the content and teaching of mathematics from year 1 through year 14, inclusive. To achieve this purpose we make the following suggestions:

1. Reorganize to provide three sections.
   - Section A. Mathematics for the elementary school, grades 1–6.
   - Section B. Mathematics for the secondary school, grades 7–12.
   - Section C. Mathematics for the junior college. (This section to be organized in cooperation with the Mathematical Association of America, Inc.)
2. Provide for three vice-presidents to be responsible for the various sections and to see that each section has a place on the program of the meetings of the National Council. These three vice-presidents would replace the present provision for two vice-presidents.
3. Devote a reasonable part of each issue of THE MATHEMATICS TEACHER to each one of these sections.
4. The Board of Directors of the National Council of Teachers of Mathematics increase the dues for membership in the Council as follows: Regular dues, $2.50 per year; Sustaining member, $4.00 per year.

The above suggestions are respectfully submitted for consideration by the Committee on Reorganization of the Constitution of the National Council of Teachers of Mathematics.

III. Miscellaneous items.

1. Cooperation of this Commission and the National Council of Teachers of Mathematics with the Consumer Education Study of the National Association of Secondary-School Principals was recommended.
2. It was noted that Mr. Schorling is to speak at the Chicago meeting of the Mathematical Association. It was suggested that he discuss with that group plans for more effective co-

operation between the Council and Association.
3. Messrs. Betz snd Schorling were delegated to contact the Army and Navy, respectively, for the purpose of securing a man from each branch, who knows the over-all picture of the educational work of his branch, to work with the Commission for the duration of the war.
4. Plans for a second report of the Commission to be published in the May issue of THE MATHEMATICS TEACHER were outlined.
5. The Commission adjourned to meet again on December 2–3, 1944.

Silver Burdett Company announces the appointment on November 1, 1944, of Mr. G. Dan Robison, Jr., as Eastern Sales Manager with headquarters in the New York Office. Mr. Robison has been sales representative in Tennessee for the past nine years, with sales responsibilities also in several neighboring states.

Formerly Mr. Robison was a teacher in the Paris (Tenn.) High School. He received his Bachelor degree from Cumberland University and did his graduate work at George Peabody College.

Mr. Robison's new duties include the sales management of all the seaboard states north of Virginia.

The Mathematics Section of the Western Pennsylvania Education Conference met in Pittsburgh on October 14, 1944. The speaker, Dr. Ralph Beatley of the Harvard Graduate School, took for his topic "A New Demonstrative Geometry for Secondary Schools."

Dr. Beatley was the guest of the Executive Council at a luncheon in the Royal York dining room, after which the Nationality Rooms in the Cathedral of Learning were visited.

The following members compose the Executive Council for 1944–1945:

Miss Ida Price, President
Dr. Donald Steele, Vice-President
Miss Isabelle Blyholder, Secretary-Treasurer
Miss Bertha Kirkpatrick, Past-President
Miss Catherine Lyons, Teacher, Oliver High School
Dr. James Taylor, Prof. of Mathematics, U. of Pgh.
Mr. Wm. Hulley, Teacher, Carrick High School

The median level of education of American soldiers in this war is the second year of high school, as compared with the sixth grade education held by the average doughboy in the last war, the Office of War Information reported today on the basis of comparative statistics compiled from representative sampling studies conducted by the United States Office of Education, Federal Security Agency, and the War Department.

In this war, 23.3% of the soldiers had completed four years of high school, whereas only 3.5% of the soldiers in the last war had done so.

The two largest groups in both wars, however, included those who had completed no more than five to eight years of grade school. The percentage was 27.4% in this war, as compared with 55.5% in the last war.

The number of persons who have completed no more than the first four years of grammar school, in this war amounted to 3.5%, as compared with 24.4% in the last war. No comparison of the rates for rejection for illiteracy can be made between this war and the last since in both cases these rejections have been closely associated with other causes for rejection and comparable statistics cannot be obtained.

Four years of college or more had been completed by 3.6% of the soldiers in this war, as compared with one per cent in the last war.

A percentage table, comparing Army enlisted men of this war and of the last war on the basis of the amount of formal education they had received, follows:

College	This War	Last War
4 year and over	3.6	1.0
3 years	2.0	0.8
2 years	4.0	1.3
1 year	6.3	1.5
High School		
4 years	23.3	3.5
3 years	11.2	2.4
2 years	10.9	4.2
1 year	7.8	5.4
Grade School		
8 to 5 years	27.4	55.5
4 to 0 years	3.5	24.4

Percentages in the last war were based on a representative sampling of 78,940 enlisted men. Percentages on this war were based on a representative sampling of about 100,000 Army enlisted men.

Facts on educational levels of service men and women in the present war were supplied to the Office of Education by all branches of the armed forces. Because similar facts for the last war were available only for Army enlisted men, information on the educational levels of men and women in branches of the armed forces other than the Army was not included. The Office of Education study on educational levels was done by a committee including Dr. Ernest V. Hollis, principal specialist in higher education, chairman; Dr. Francis G. Cornell, chief of research and statistical service, and Dr. Carl A. Jessen, senior specialist in secondary education, all of the Office of Education.

Miss Katherine Young was president of the Mathematics Section of The State Teachers Association of Iowa which met at Des Moines on November 3.

Dr. George David Birkhoff, who was honored by scientists all over the world as one of the leading mathematicians of this country, died at his home on Memorial Drive on November 12. Sixty years old, he was a professor of mathematics at Harvard.

In 1917 Dr. Birkhoff won a $1000 prize offered by the American Association for the Advancement of Science for a paper which posed the possibility of what was termed "a new type of elastic body" to account for such unexplained phenomena as the line in the spectrum.

Two years ago he presented an intricate gravitational theory, opposed to Einstein's, which made use of a "perfect fluid" by which Dr. Birkhoff reported he was able to construct a gravitational potential and gravitational forces

in which the formulae were the same as in the three classical tests of Einstein's generalized theory.

Dr. Birkhoff was graduated from Harvard in 1906 with an M.A. degree and received a Ph.D. degree from the University of Chicago a year later. He joined the Harvard faculty in 1912, and was holder of many scientific awards.

When he retired from the presidency of the American Association for the Advancement of Science in 1937 he declared that his mathematical research had convinced him that faith and intuition were essential in science.

Pearle Evelyn Anderson, St. Paul, Minn., former teacher and social worker at Sauk Center, Minn., was today commissioned a second lieutenant in the Army of the United States upon the graduation of the fifty-fifth Officer Candidate class at the Third WAC Training Center here.

Lt. Anderson was working in the personnel office at Fort Knox, Ky., at the time she was notified to report here for officer's training. After basic training in the Corps, she had completed a course at Army Administration School, Alpine, Tex.

Prior to her enlistment the Minnesota officer was a teacher and social worker at the Home School for Girls, Sauk Center. She also held previous teaching positions in the public schools of Henning, Deer Creek, and Eagle Bend, Minn. The WAC officer has a bachelor of education degree from St. Cloud State Teachers College, Minn., and until recently she was a member of the National Association of Mathematics Teachers.

At the first meeting of the Men's Mathematics Club of Chicago on October 20, 1944, Professor L. L. Thurstone of the University of Chicago discussed the multiple factor analysis for the solution of psychological problems. At their second meeting on November 17, 1944, Dr. J. T. Johnson of the Chicago Teachers College spoke on "The Present Status of the Metric System," and Mr. Joseph J. Urbancek of the same College spoke on "The Corliss Symbolic Operators."

Officers 1944–1945

Glenn F. Hewitt, Pres., Von Steuben High School, Chicago, Illinois.

W. W. Barczewski, Sec.-Treas., Waukegan Township High School, Waukegan, Illinois.

Glenn L. Anderberg, Rec. Sec., Waukegan Township High School, Waukegan, Illinois.

Historian, C. M. Austin, Oak Park High School.

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Exhibit Committee: John P. Esposito, Chairman, Crane High School; J. J. Urbancek, Lane Technical High School; Hobert Sistler, Morton High School.

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Wells—H. Haggard.
Woodrow Wilson Junior College—J. M. Kenney.
Wright Junior College—W. W. Gorsline.

The Fall Meeting of the Connecticut Valley Section of the Association of Teachers of Mathematics in New England was held on Saturday November 4, 1944 at the Hotel Bond in Hartford.

Program

Morning Session

11:00 "Geometrical Models, Three and Four Dimensional and Multi-dimensional Figures."
Exhibition and Discussion
Mr. Paul S. Donchian
Hartford, Conn.
"Physicists and Chemists Use Mathematics."
Dr. Kurt Wohl, Princeton University
Princeton, New Jersey

1:00 Luncheon.

Afternoon Session

2.00 Business Meeting.

2:15 "A Training Course of Engineering Aides."
Dr. Julia Wells Bower
Connecticut College, New London, Conn.

"Aviation Uses Mathematics."
Mr. A. R. A. Brooks
Hartford High School, Hartford, Conn.

Officers of the Connecticut Valley Section: Levings H. Somers, President, Pomfret School.

Elizabeth A. Harkness, Vice-President, Northampton High School.

George E. Frost, Secretary, Holyoke High School.

Ethelyn M. Percival, Treasurer, Westfield High School.

Laura D. Sargent, Director, Ethel Walker School.

Neal H. McCoy, Director, Smith College.

Past Presidents: Henry P. Marsh, '20; Percy F. Smith, '21; *M. M. S. Moriarty, '22; *Eleanor C. Doak, '23; Joe G. Estill, '24; Joshua I. Tracey, '25; *Lyon L. Norton, '26; *John W. Young, '27; Rolland R. Smith, '28; Harriet R. Cobb, '29; Melvin J. Cook, '30; Bancroft H. Brown, '31; Dorothy S. Wheeler, '32; H. W. Dadourian, '33; *David D. Leib, '34; Nelson A. Jackson, '35; Frederick Mockler, '36; William Fitch Cheney, Jr., '37; Sarah K. Everts, '38; Leland W. Smith, '39; Marie Litzinger, '40; William G. Shute, '41; Maytscherl Walsh, '42; Neal H. McCoy, '43.

* Deceased.

The Fall Meeting of the Mathematics Section of the Eastern Division of the Colorado Education Association was held at Denver on October 27, 1944.

Program

1. *Navigation of the Future*
   Professor A. W. Recht, University of Denver
2. *How Mathematics Is Taught in the Primary Grades*
   Helen Taylor, Denver Public Schools
3. *Why Teach Geometry*
   Helen Phelps and Elizabeth Stancliff, Denver Public Schools

The Bulletin is the official publication of the Mathematics Section of the Eastern Division of the Colorado Education Association and contains very good articles. The Bulletin Staff consists of:

Ruth Irene Hoffman, 338 Fox Street, Denver, Colorado

Earl E. Bragg, 2035 So. Fillmore, Denver, Colorado

Members of the Executive Council: President, Wendell Wolf, 2821 W. 34th Avenue, Denver; Vice-President, A. E. Mallory, O.S.O.E., Greeley; Secretary-Treasurer, Mary Doremus, 517 S. Vine, Denver.

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Term expires 1945: R. T. Ashbaugh, Longmont; Katherine Compton, Denver; Kenneth Gorsline, Denver; Ruth Irene Hoffman, Denver.

Term expires 1946: Dwight Gunder, Ft. Collins; Ann Kane, Denver; Margaret McGinley, Denver; Gladys Travers, Adams City.

The Mathematics Section of the Minnesota Education Association held its Fall Meeting on October 26, 1944 in the St. Paul Hotel Cassino at 1 P.M.

Program Theme: "Immediate Aims and Long-Time Goals"

"An Educator Looks at Mathematics"—G. Lester Anderson, Director, Teacher Training, University High School

"Our Council Works for Us"—Edith Woolsey, Second Vice President, National Council of Teachers of Mathematics

Panel Discussion:

*"Trends in Junior High School Mathematics"—C. W. Wood, Principal, East Junior High School, Duluth

"The Mathematics Work Room"—Jessie R. R. Smith, Technical High School, St. Cloud

"The Place of Statistics in the High School Mathematics Program"—C. J. Hoyt, Mankato State Teachers College

"Aviation, A Unit in Mathematics"—Lois K. Turner, Department of Mathematics, University High School

"Summary and Comments on Panel Theme: Immediate Aims and Long-Time Goals"—William L. Hart, Professor of Mathematics, University of Minnesota

Business Meeting

* Due to emergency surgery, Dr. Wood could not be present; Mr. C. O. Bemis, St. Cloud State T. C. substituted.

Officers for 1945–1946

President: Mr. George S. McCutcheon, University High School, Minneapolis.

Vice-President: Miss Deloras Evans, Fairmont, Minn.

Secretary: Miss Esther Gunderson, Hibbing, Minn.

Retiring Officers: President: Miss Edna Norskog, Alexandria Sr. H. S.; Vice-President: Mr. George S. McCutcheon, University H. S.; Secretary: Miss Lillian Carew, East Jr. H. S., Duluth.

U. S. Office of Education Releases Fourteen New Films

Fourteen new motion pictures to aid in the training of war production workers in vocational schools and war industries have been released by the U. S. Office of Education, it was announced today.

The new films cover such subjects as aircraft maintenance, pipefitting, welding, and engineering. One of the pictures shows how to calculate proportion, percentages squares, and square roots on a slide rule. A previously released Office of Education film shows how to multiply and divide on a slide rule. People who have never before used a slide rule can, after seeing the motion pictures, pick up a rule and perform simple calculations.

In addition to the motion pictures, filmstrips, which review and clarify important points in the films, and instructor's manuals, which describe the best ways of using the visual materials, are also available. Motion picture, filmstrip, and manual form an "instructional unit of visual aids."

The 14 new Office of Education films, like the 177 other titles already in use, were planned and supervised by technical experts and visual educators. Subjects were chosen for today's

training needs and were approved by the War Manpower Commission. Actual production was done under contract by eight different motion-picture producers—Loucks & Norling Studios, Ted Nemeth Studio, Pathescope Company of America, and Willard Pictures, New York City; Defrenes and Company, Philadelphia; Calvin Co., Kansas City; Ray-Bell Films, Minneapolis; and Gene K. Walker, San Francisco.

Office of Education training films may be purchased from Castle Films, Inc., 30 Rockefeller Plaza, New York City, and may be rented from many 16-mm. educational film libraries. Filmstrips sell for $1 each. Instructor's manuals are furnished without charge to users of the films.

Following are the titles, running times, and prices of the 14 motion pictures. Schools receive a 10% discount.

49.	Precision Gage Blocks	18 min.	$25.22
50.	The Bevel Protractor	15 min.	22.73
122.	Pipe Fabrication with Jigs	22 min.	28.33
175.	The Electron—An Introduction	16 min.	23.35
189.	The Guided Bend Test	17 min.	24.60
190.	Oxy-acetylene Welding Light Metal	21 min.	27.71
239.	Sawing an Internal Irregular Shape	32 min.	38.13
240.	Filing an Internal Irregular Shape	27 min.	33.78
257.	Installing Landing Gear	19 min.	26.47
258.	Attaching and Aligning Wings	20 min.	27.09
354.	The Slide Rule (Percentage, Proportion, Squares and Square Roots)	21 min.	27.71
376.	Procelain Protected Surface Wiring	19 min.	25.85
377.	Cable Surface Wiring	17 min.	24.60
404.	Feeding the Patient	15 min.	22.11

Rules for National V-Mail Letter Contest Sponsored by the United States Treasury Department

Prepared by Education Section War Finance Division, U. S. Treasury
Washington 25, D. C., November 28, 1944

Subject: "What we here at school are doing to help bring you home sooner."

Eligibility: Any junior or senior high school paper is invited to sponsor a contest to select outstanding V-Mail letters actually sent overseas. If printed in a high school publication or local newspaper the letters may then be submitted in the national contest.

Preparation of Entries: Entries, clipped from the newspaper in which they appeared, should be mounted on 8½″×11″ cardboard carrying the following information:

1. Name of publication and date of issue
2. Name and address of school
3. Name of student writer

Date and Place for Entries: Letters may be submitted any time until January 27, 1945. They should be sent in care of Mr. Earl Whitbeck, President of the Columbia Scholastic Press Association, 214 South Third Street, Mechanicville, New York. Columbia Scholastic Press Association has offered its facilities for handling the entries. Any school may participate whether or not a member of the CSPA.

Prizes: THIS WEEK magazine will award three War Bond prizes of $100, $50, and $25 for the three winning letters selected by the judges: Bob Hope, Dorothy Thompson, Mark Van Doren, and Sidney Whipple, assistant editor of the New York WORLD TELEGRAM. In addition any entry which is published in THIS WEEK will be paid for at regular space rates. State winners will receive special citations from the Treasury Department.

Announcement of Winners: Announcement of the winning letters will be made at the annual meeting of the Columbia Scholastic Press Association on March 24, 1945.

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—James W. Hoge, supervisor of the Teaching of Mathematics, University High School, Oakland, California.

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